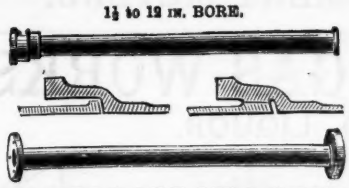
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXI. No. 1570.] LONDON, JUNE 13, 1893. [45TH YEAR. PRICE 6d.

GAS AND WATER PIPES

1¼ to 12 IN. BORE.



THOMAS ALLAN & SONS,

Bon Lea Foundry,

SOUTH STOCKTON-ON-TEES.

ALSO MANUFACTURERS OF
SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.

GLASGOW OFFICE: 24, GEORGE SQUARE.
Telegrams:
"BONLEA, STOCKTON-ON-TEES."
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— ESTABLISHED 1830. —

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Manufacturers & Contractors.

THE ONLY MAKERS OF

PATENT ANTIMONY PAINT,

Parker's Imperial Black Varnish,

Oxide Paints, Oils, and General Stores for Gas and Water Works.

WORKS:
ORMSIDE STREET, OLD KENT ROAD,
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WOLSTON'S

TORBAY PAINTS

Special Quotations to Gas Companies.

DARTMOUTH, DEVON.

Lanemark Coal Co.,

LIMITED.

LANEMARK CANNEL

AND GAS COALS.

Quotations and Analysis on application to

LANEMARK COLLIERY,

NEW CUMNOCK, N.B.

Shipping Ports: All the principal Scotch Ports.

THE "C" BURNER.

NEW HIGH-POWER GAS-LIGHT.

INCANDESCENT GAS-LIGHT SYSTEM.

—o—

Consumes

4 cubic feet per hour.

Gives a light of

70 to 80 candle power.

Brilliant Light.

—o—

Perfectly Steady and

Noiseless.

Smokeless.

Reduced Heat.

Can be attached to any Gas-Fittings.

THE TRIUMPH OF GAS OVER ELECTRIC LIGHT.

Taking Gas at 3s. per 1000 cubic feet and Electric Light at 8d. per Board of Trade unit, the "C" Burner will produce an equal amount of light at **One-eighth the cost of Electric Light.** This cannot be disproved.

Prices and particulars on application to

THE INCANDESCENT GAS-LIGHT COMPANY, Ltd.,

14, PALMER STREET, WESTMINSTER, LONDON.

Near St. James's Park Station.

SAWER AND PURVES,

LATE

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER,

Manufacturers of

IMPROVED CONSUMERS' WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

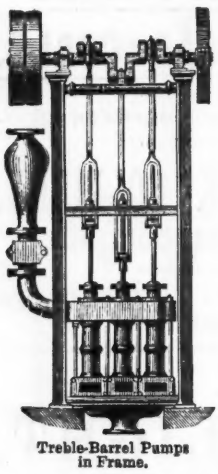
AND

IMPROVED DRY GAS-METERS.

SPECIALITY: PATENT CASH PREPAYMENT METERS.

STEAM & HAND PUMPS FOR GAS-WORKS,

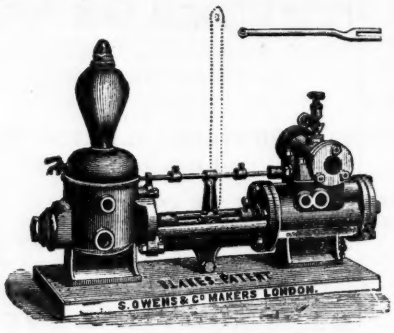
FOR PUMPING TAR, WATER, AND LIQUOR.



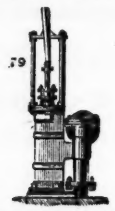
Treble-Barrel Pumps in Frame.

Syphon Pump.

Double-Barrel Force-Pump in Frame.



BLAKE'S
PATENT
STEAM PUMPS.
20,000 IN USE.



Improved Double Action Pump.

Cast-Iron Hand-Pump.

Wrought-Iron Portable Pump.

S. OWENS & CO., Hydraulic, Gas, & General Engineers, WHITEFRIARS ST., LONDON, E.C.

SOLE MANUFACTURERS OF

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S. O. and Co.'s New Catalogue of Gas Apparatus and General Machinery can be had on application.

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THORNCLIFFE IRON-WORKS, near SHEFFIELD,

MANUFACTURERS OF

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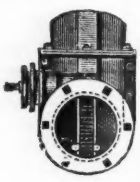
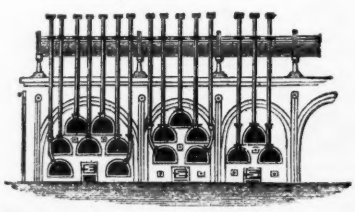
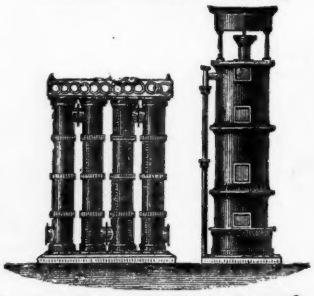
WITH RACK & PINION
OR
Internal or External
SCREWS, of all Sizes.
GASHOLDERS,
AND
Gasholder Tanks.



CAST-IRON RETORTS,
RETORT-BED FITTINGS,
And Retort-House Appliances
of every description.
Iron Roofs, Columns, Girders, Floor Plates and Tools, &c.



WROUGHT AND CAST IRON
CONDENSERS,
SCRUBBERS, & WASHERS,
TAR AND LIQUOR PUMPS, &c.



PATENT
CENTRE VALVES
for working Purifiers,
Also Bye-Pass & Stop Valves.

PURIFIERS with Planed Joints,
HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS,
WOOD GRIDS.
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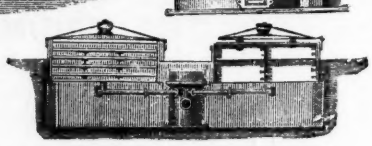

DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

THE BARROWFIELD IRON-WORKS, LIMITED,

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GLASGOW.

Telegraphic Address:
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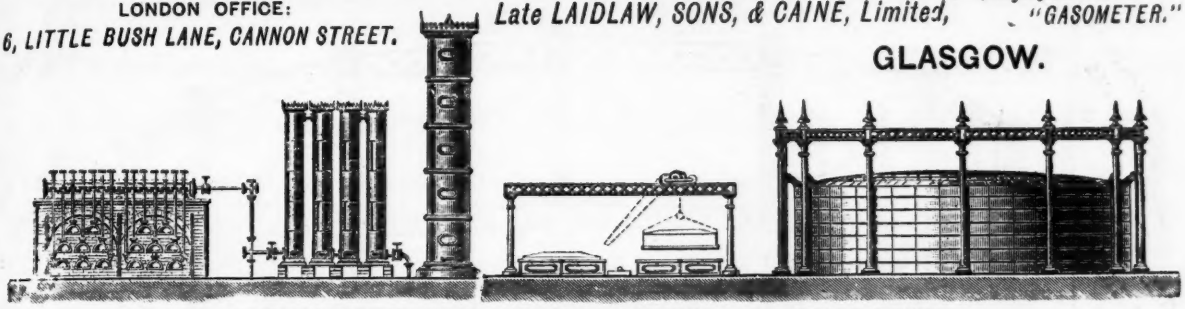

MANUFACTURERS OF ALL KINDS OF GAS PLANT.

RETORT-BENCH FITTINGS; SIEMENS'S REGENERATIVE AND ORDINARY FURNACES;
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PURIFIERS, WITH PLANED AND CEMENT JOINTS;
DRY AND HYDRAULIC CENTRE-VALVES;
HYDRAULIC AND HAND-POWER LIFTING APPARATUS;
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FOUR-WAY COCKS AND HYDRAULIC VALVES;
CAST-IRON GAS, WATER, & STEAM PIPES & CONNECTIONS; WROUGHT-IRON TUBES & FITTINGS;
IRON ROOFING, MARKET BUILDINGS, BRIDGES, GIRDERS, STEAM BOILERS;
PROMENADE PIERS AND LOADING WHARVES.

MANUFACTURERS OF OIL PLANT OF EVERY DESCRIPTION.

HENDERSON'S Patent Retorts, Condensers, Stills, Cast and Wrought Iron Tanks, Ammonia Stills, Wrought-Iron Gas-Mains, &c., &c.

DESCRIPTIVE SPECIFICATIONS AND ESTIMATES ON APPLICATION.

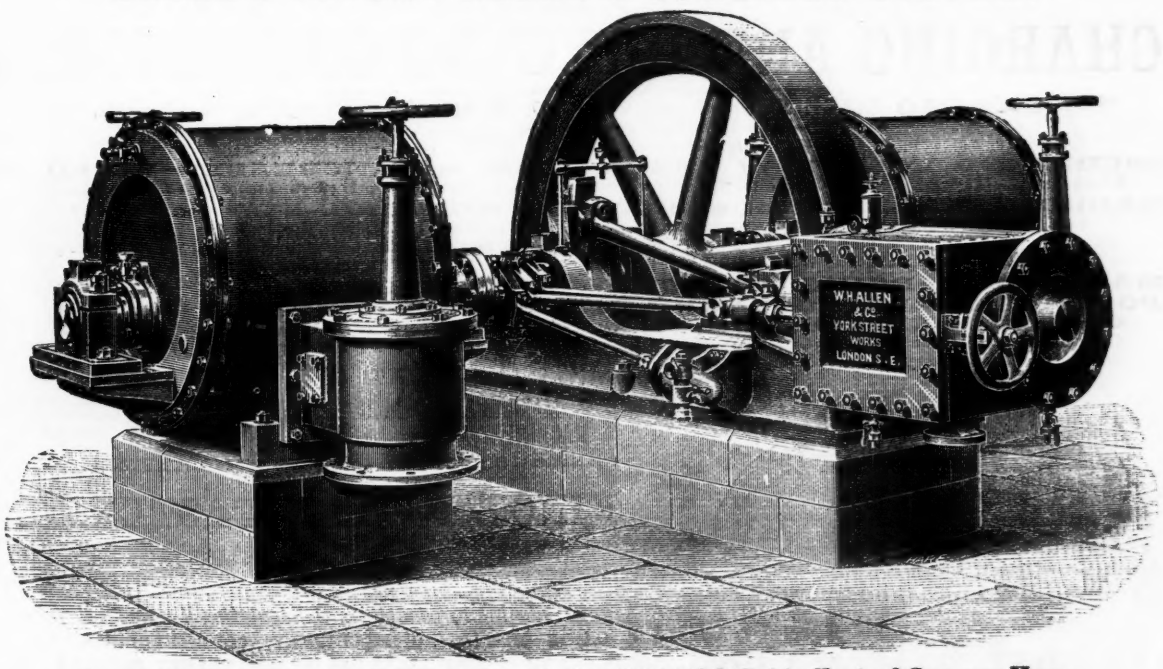
W. H. ALLEN & CO.,

York Street Works, LAMBETH, LONDON, S.E.,

MAKERS OF THE MOST IMPROVED FORM OF

GAS EXHAUSTING MACHINERY.

BEALE'S PATENT—ALLEN'S COMBINED SYSTEM.

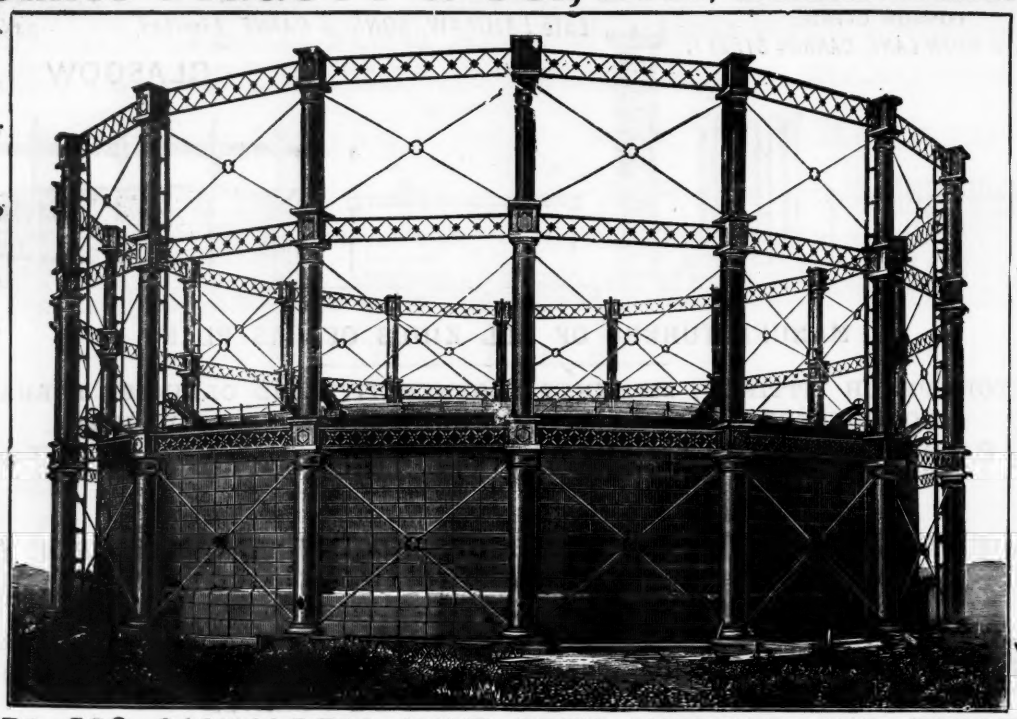


Pair of Non-Oscillating Exhausters, passing 200,000 Cubic Feet of Gas per Hour.

THOMAS PIGGOTT & CO., LTD., BIRMINGHAM.

LONDON OFFICE: ST. THOMAS APOSTLE, E.C.

GAS PLANTS, BOILERS, ENGINES, PUMPS, ROOFS, RETORT FITTINGS, ETC.



TELEGRAPHIC ADDRESS: ATLAS, BIRMINGHAM.

WELDED & RIVETED PIPES, MAINS, RETORT-LIDS, & CAST TANKS, PURIFIERS.

OVER 500 GASHOLDERS HAVE BEEN SUPPLIED AND ERECTED,

INCLUDING THOSE SUPPLIED TO THE FOLLOWING GAS COMPANIES AND CORPORATIONS:

BATH.	BOLTON.	BRISTOL.	CHELTENHAM.	LEAMINGTON.	PRESTON.	SHEFFIELD.
BELFAST.	BOMBAY.	BRISBANE.	HARTLEPOOL.	LIVERPOOL.	READING.	STOCKHOLM.
BECKTON.	BRADFORD.	CARDIFF.	LEEDS.	NOTTINGHAM.	RIO GRANDE.	SYDNEY.
BIRMINGHAM.	BRIGHTON.	COVENTRY.	LEICESTER.	OLDHAM.	SOUTH METRON.	VIENNA.

WEST'S GAS IMPROVEMENT Co., Ltd.,

Engineers, Ironfounders, & Contractors,

ALBION IRON-WORKS, MILES PLATTING, MANCHESTER,

MANUFACTURERS OF

WEST'S PATENTED MACHINERY

FOR

CHARGING AND DRAWING GAS-RETORTS.

OVER **240** MACHINES AT WORK AND IN COURSE OF CONSTRUCTION.

Advantages attending its use are:—

INCREASED VOLUME of GAS per TON, and INCREASED YIELD per Retort.—The system of breaking and distributing the coals in an even layer in the retorts effecting more perfect carbonization.

REDUCTION in LABOUR and COST of WORKING.—In Works where this System of charging and drawing Retorts is adopted, there has been effected a substantial saving in the cost of Gas Manufacture in the Retort-House; the amount saved varying in different Gas-Works from **8 PENCE** to **15 PENCE per Ton** of coal carbonized. Full particulars will be forwarded upon application to W. G. I. Company, Limited.

MANUAL CHARGING AND DRAWING MACHINES.

POWER CHARGING AND DRAWING MACHINES, driven by COMPRESSED AIR, STEAM, or ROPE. The power machines are applicable to circular, oval, or Ω-shaped retorts and mouthpieces, and are the most perfect, economical, efficient, and durable machines made. They are constructed on principles founded by long and extensive experience in this special branch of gas engineering and the manufacture of gas.

MAKERS OF COAL BREAKING, ELEVATING, AND CONVEYING MACHINERY, COKE BREAKING AND WASHING MACHINERY.

Sole Makers of **CIRCULAR, OVAL,** or Ω-shaped **MOUTHPIECES** with Morton's Self-Sealing Lids, fitted with

KING'S PATENT FASTENINGS,

secure a very tight joint; and at the same time the eccentric motion given to the Lid effectually removes the Tar from the surfaces of the Joint.

N.B.—The whole of these Fittings are made of Wrought Iron. Several Thousands in use.

West's Improved Combined Regulating Liquor Seal Valve.

OXIDE ELEVATING MACHINERY, COKE BARROWS, VALVES, AND ALL GAS-WORKS PLANT, &c.

Illustrated Catalogue sent upon application.

Mr. JOHN WEST, M.Inst.C.E., *Managing Director.*

And Fittings and Accessories.

LAMBERT BROS., WALSALL,

MANUFACTURERS OF

WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM,

BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES, TOOLS, &c., AND OF WARNER'S PATENT MARKET GAS STAND-PIPE.

LONDON: LAMBETH BRASS & IRON CO., Short Street, LAMBETH.

JOHN BROWN & CO., LTD., SHEFFIELD,

Proprietors of

ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 19-candle gas per ton.

Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.

Telegrams: "ATLAS SHEFFIELD."

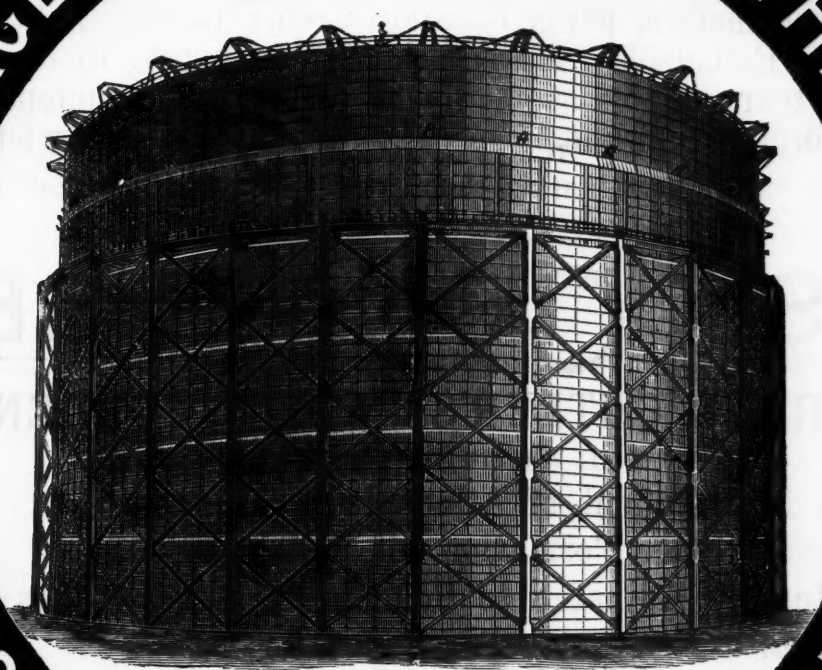
CLAYTON SON & CO LTD

MAKERS OF

WORKS LEEDS

THE LARGEST GASHOLDER IN THE WORLD.

GASHOLDERS OUR SPECIALITY



CAPACITY 12 MILLION CUBIC FT.

ERECTED AT EAST GREENWICH FOR THE South Metropolitan Gas Company

IT HAS SIX LIFTS 30 FT DEEP EACH AND IS 300 FT DIAR

MAKERS OF GAS PLANT OF EVERY DESCRIPTION

ROOFS PURIFIERS &c. ALSO

ADDRESS LONDON 60, QUEEN VICTORIA ST.

TELEGRAPHIC "GAS, LEEDS."

GASHOLDERS OF ANY SIZE

ERECTED & COMPLETED WITHIN 12 MONTHS AND AT THE TIME SPECIFIED

THE CHARLES HUNT GAS WASHER

(HUNT'S PATENT).

By this Washer, which performs the functions of both a Washer and Scrubber, any tarry matters are intercepted, and the whole of the Ammonia is removed from the Gas, together with a high percentage of Carbonic Acid and Sulphuretted Hydrogen.

This is effected by causing the Gas to pass in finely-divided streams through a series of light seals, formed by inverted troughs, having their perforated sides submerged in liquid, and placed one above another. Clean Water, being introduced at the top and flowing from tier to tier in the opposite direction to the Gas, leaves the Washer at the bottom as strong Ammoniacal Liquor.

The lower tiers perform the function of a most efficient Tar Extractor, removing from the Gas all traces of tarry matters.

The total back pressure due to this apparatus does not exceed about 7 ins.

The advantages claimed for the Washer are: **It is entirely automatic in action**, depending only upon a constant supply of clean water, proportionate in quantity to the volume of Gas passing. **It has no moving parts**, and thus **no driving machinery or power** is required other than a slight extra duty thrown on the Exhauster. **It is economical in first cost**; there is **practically no wear and tear**; and consequently **no expense for maintenance.** It is **compact in form, occupies little space, and requires no heavy foundations.**

For prices and particulars apply, stating capacity required, to the Sole Makers, Messrs. S. CUTLER & SONS.

GAS CONDENSERS

MORRIS & CUTLER'S PATENT CONDENSER

IS IN USE AT OVER 80 GAS-WORKS.

It is Independent of Atmospheric Temperature,
Prevents the Formation of Naphthaline,
Is Readily Adjusted to Condense varying makes of Gas,
Acts as a Frictional Tar-Separator,
Efficient, Compact, Convenient, Ornamental.

Sole Makers, Messrs. S. CUTLER & SONS.

GASHOLDERS of EVERY SIZE and TYPE.

SAML. CUTLER & SONS, MILLWALL, LONDON.

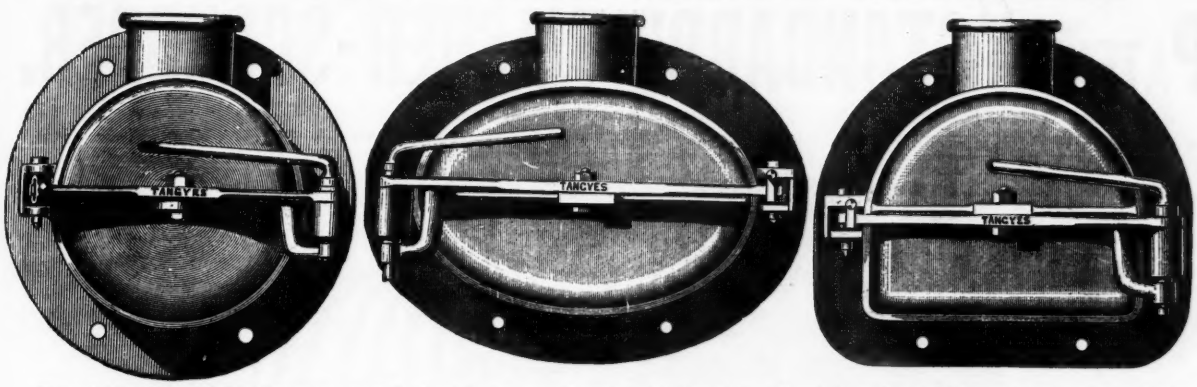
Westminster Office: 16, GT. GEORGE STREET.

TANGYES LIMITED, CORNWALL WORKS BIRMINGHAM.

AND AT LONDON, NEWCASTLE, MANCHESTER, GLASGOW, SYDNEY, MELBOURNE, JOHANNESBURG, GENOA, BILBAO, & ROTTERDAM.

MORTON'S SELF-SEALING RETORT-LID,

With Holman's Anti-Friction Catch, Self-Sustaining Cross-Bar, and Improved Eccentric Bolt.



These Retort Lids and Fastenings are made in three forms, round, oval, and ⌂ (as shown above), in each of which we have a very extensive variety of patterns, from which Gas Engineers contemplating the adoption of these Lids are recommended to make their selection, in order to avoid cost of pattern-making, delays, &c., &c.

QUOTATIONS WILL BE GIVEN ON RECEIPT OF PARTICULARS OF REQUIREMENTS.

LIST OF PATTERNS ON APPLICATION.

Telegrams: "TANGYES, BIRMINGHAM." No. 90 E.

GASHOLDERS

A Four-Lift Gasholder, nearly 200 feet high and 8 million cubic feet capacity, has been recently erected by us for The Gaslight and Coke Company, London.

PURIFYING MACHINES.

PURIFIERS. SULPHATE PLANT.

Weck's Centre-Valve.

C. & W. WALKER,

MIDLAND IRON-WORKS, DONNINGTON, NEAR NEWPORT, SHROPSHIRE;

10, Finsbury Square, London.

"FORTRESS DONNINGTON." "FORTRESS LONDON."—Telegraphic.

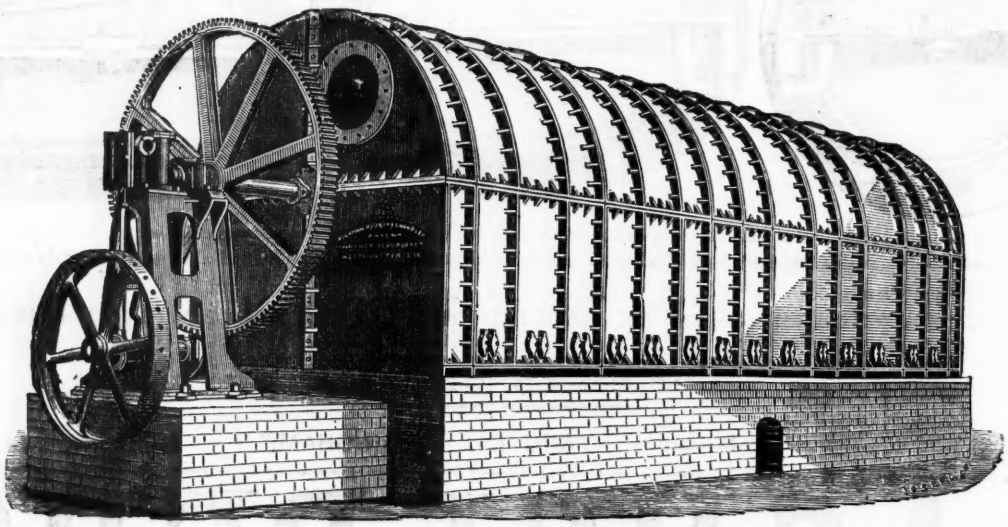
KIRKHAM, HULETT, & CHANDLER,

LIMITED.

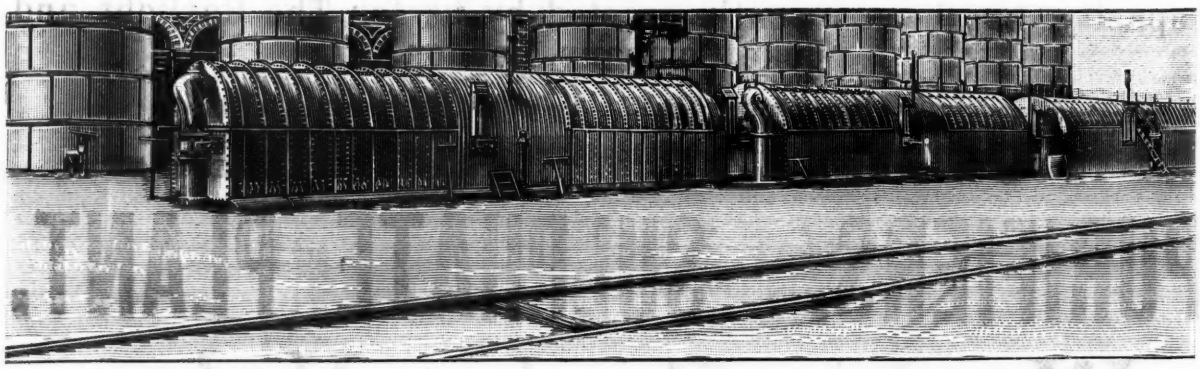
(SIDNEY HERSEY, Managing Director.) (J. CHANDLER, Engineer.)

Patentees of the

PATENT "STANDARD" WASHER-SCRUBBER.



☛ **465 of these Machines (capable of dealing with 440,807,000 cubic feet of Gas daily) have been supplied, which fact is given as evidence of this apparatus being the Most Efficient of any in the Market for the extraction of Ammonia, Carbonic Acid, and Sulphuretted Hydrogen, from Coal Gas.**



View of SIX PATENT "STANDARD" WASHER-SCRUBBERS, erected at the Beckton Station of The Gaslight and Coke Company; the Engines driving same being under Galvanized Iron Covers. Six additional Machines are now in use at these Works.

ADDRESS:—

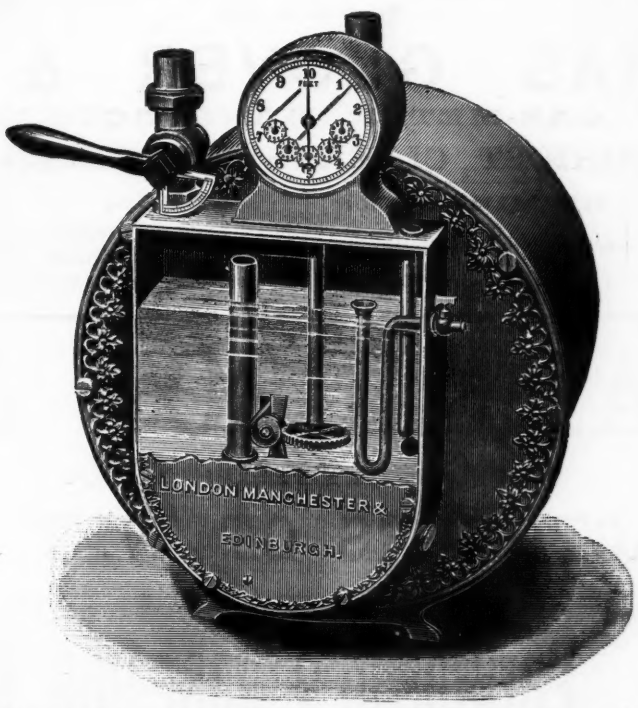
3 & 4, PALACE CHAMBERS, BRIDGE STREET, WESTMINSTER, S.W.

AIR PURIFICATION.

It is now generally agreed that the use of Oxygen, either with or without the diluent Nitrogen, is indispensable for the complete and economical Purification of Coal Gas with either Oxide of Iron or Lime.

Of the various methods proposed for doing this—namely, by drawing in a known percentage of Air with the Foul Gas, or by using a separate and independent oxygen-producing plant (in both of which cases the Spent Lime is rendered innocuous), or by revivifying the sulphided material by exposure to the atmosphere, and then replacing in the Purifiers—the first-named is undoubtedly the most simple and convenient.

All that is necessary is to connect a suitable Air-Meter to the Foul Main on the Retort side of the Exhauster, through which the Air is drawn and measured; and thus the required percentage can be regulated with great exactitude.



The Illustration shows a Meter specially designed for the purpose. The Case is Cast Iron; the Drum and Spout being of Tinned Copper.

A Cock, with Pointer and Quadrant, is provided so that the necessary adjustment can be readily made. This is easily done (the make of Gas being known, and the desired percentage of Air being determined upon) by a minute's observation of the large Index Dial.

Prices and further particulars on application to

W. & B. COWAN,

ESTABLISHED 1827

SMITH SQUARE WORKS, WESTMINSTER,
LONDON, S.W.
TELEPHONE No. 3260.

DUTTON STREET WORKS,
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TELEPHONE No. 1545.

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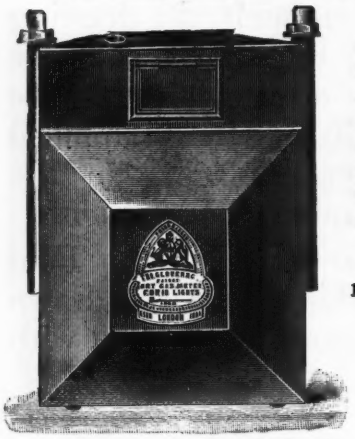
"DISC LONDON." "DISC MANCHESTER." "DISC EDINBURGH."

Telegraphic Code used, A.B.C. 4th Edition. Special Code furnished on application.

[ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.]

LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;
The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.



1st.—Are a remedy for all the defects of Wet Meters.
2nd.—Are suitable for all Climates, whether hot or cold.
3rd.—Incur no loss of Gas by Evaporation.
4th.—Cannot become fixed by Frost, however severe
5th.—Are the most accurate and unvarying measurers of Gas.
6th.—Prevent jumping or unexpected extinction of the Lights.
7th.—May be fixed either above or below the level of the Lights.
8th.—Cannot be tampered with without visibly damaging the outer case.
9th.—Will last much longer than Wet Meters.
10th.—Will not cost more than one-half for repair that Wet or Water Meters do.
Are upheld for five years without charge.

Telegraphic Address: "GOTHIC LONDON."
Telephone No. 6725.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

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BIRMINGHAM: 3, BRIDGE ROW, DERITEND. *Telegraphic Address*: "*GOTHIC.*"

LEEDS: BOAR LANE CHAMBERS, 4, BASINGHALL STREET. *Telegraphic Address*: "*GOTHIC.*"

MANCHESTER: 37, BLACKFRIARS STREET. *Telegraphic Address*: "*GOTHIC.*"

W. PARKINSON & CO.

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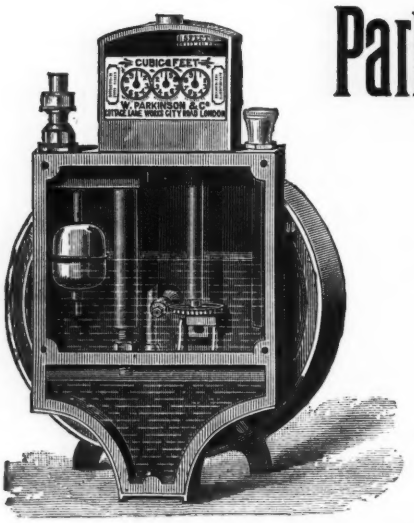

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(See also Advt., p. 1124.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 13, 1893.

The Collapse of Coal.

THE fall in the selling price of all sorts of gas coals is a serious factor in the actual commercial and industrial position of the country, to which sufficient attention has hardly yet been paid. Indeed, its influence cannot begin to be felt for some time to come; and, when it does attain to its full force, its consequences will be all the more astounding to those who are now unaware of what is in preparation. For the present, all that is to be seen is the spectacle of coal producers "tumbling over one another," so to speak, in their anxiety to secure contracts almost at any rates, and for any length of time ahead. This is particularly the case with the suppliers of sea-borne gas coal; but their action, of course, spoils the market conditions for their rivals; and so from all sides there arises the cry that gas coals are being given away. Gas manufacturers are congratulating themselves upon the turn the market has taken; but it is questionable if, in the long run, the sort of thing that now obtains can be good for anybody. We have always upheld the principle of "live and let live;" and we like to see coal as well as gas fetching a fair price. But the market is not to be controlled by such considerations as this. It would take too much space to discuss the multitudinous causes that may be supposed to have combined to bring about the present depression in the coal trade; and even if it were possible to arrive at a definite opinion on this matter, the utility of the exercise would be questionable. It is, in fact, a case for the application of the old proverb which tells us that "what "cannot be cured must be endured." It is certain, at any rate, that the shipping and many other trades will suffer from the same causes, whatever they may be; and as the public revenue can hardly be elastic in the circumstances, the Chancellor of the Exchequer next year will be fortunate if he can avoid making a bad matter worse by the imposition of a heavier burden of taxation. It is not often that these pages are filled with such a pessimistic view of trading prospects as we are constrained to take at the present juncture; and if our forebodings turn out to be mistaken, we shall be more than pleased.

One effect of the low value of coals upon the British gas industry requires instant recognition. It will seriously discount the efforts that have been commenced with such fair promise in so many places to supplement the ordinary method of manufacture with new systems. These have been suggested and encouraged, not only by the recent high price of good gas coals, but even more by the difficulty of procuring satisfactory supplies. This time last year, it was a truism to say that cannel was an almost unattainable luxury. Now it can be had at as reasonable a cost as ever; and the necessity for finding some substitute for this class of gas coal is consequently growing less pressing every day. There will therefore be, naturally enough, a sharp temptation to let things go on as before; and to this temptation many an easy-going gas manager will probably succumb, with the soothing reflection that he need not look out for anything else to fill his holders withal "until the times do alter." It would be easy to show that this is a wrong position to take up; but words would be wasted upon those who do not see the rights of the matter for themselves. It is impossible to say how far the recent advances of British gas manufacturers in the direction of dealing with the oil merchant instead of the cannel factor have influenced the course of the market. Nobody would argue that they have been fruitless in this sense; and it would be idle to pursue an inquiry which might only lead one round in a circle. The cannel coal owners will be content to let affairs speak for themselves, and will try to win back lost custom without sparing time to ask how far it has been their own fault that they have gone so near spoiling their old connection.

Although the drop in coals is a disconcerting fact for the carburetted water gas and the oil gas interests, there is some consolation for them in the knowledge that if coal is going cheaper, so is oil. We have heard of oil suitable for gas making being offered on terms that a few months ago would have appeared unattainable. All this simply means the same thing, in the end, as too cheap coal—bad trade. It is a small set-off against this condition that the labour combinations which troubled the gas manager at the same time that he was plagued to get coal enough to keep his works going, are falling into ruin on every side. Materials and labour are alike subject to the mysterious influence known as "the turn of the market;" and the market is turning against both, with a force that no combination or individual effort can control. "Corners" in coal, strikes among workmen—these things crop up in their day; and the men who pull the strings that circumstances put into their hands think in their vanity that they are great and powerful in the land. The wheel of Fortune revolves, and where are they? It seems to be a law of

trade that now the buyer has it, now the seller, and neither can do more than make the best he knows how of his opportunity. This is a view of the conditions of trade which is furiously opposed by "new," self-styled "progressive," dabblers in the philosophy of industry and trade; but it is as true as the equally old statement that two and two make four.

Ammonia Stills not Excisable.

As will have been seen from the report, which appeared in our last issue, of the result of the Sunderland Gas Company's case, the Excise authorities have decided not to act further in the matter of making ammonia stills subject to duty. It is only with the object of putting the last word to the record of this curious attempt to stretch the law to an obviously absurd limit that we mention the decision here. It is really not debateable, for anything more out of the way of logic than this enterprise of the Excise has seldom been heard of. It is an illustration, if such were needed, of the manner in which fiscal laws may be made to oppress and hinder the development of industry. Doubtless the excisemen thought they were right in trying to tax all stills, whatever their use, construction, or object, simply because they are stills. There are stills and stills, however, as the Board of Inland Revenue have now learnt; and consequently no more will be heard of an interference with an innocent manufacture which only the narrowest reading of the letter of the law could ever have suggested. It is perhaps too much to expect that a Government Department will always keep abreast of the expanding use of language, which, as in the case of ammonia stills, is ever in progress as manufactures develop and extend. It is not always possible to invent new terms to correspond with novel processes; but it is better that this should be done whenever convenient, especially when old words have had statutory meanings put upon them for Government officials or the Courts to apply at discretion.

The Gas Supply of Brussels.

In another column will be found an abstract translation of the report of the Gas Committee of the Brussels Municipality for the past year; and the principal figures are interesting, as showing the working of one of the very few Continental gas undertakings controlled by a local authority. There has been a remarkably good increase of consumption, amounting to 92½ million cubic feet, or about 11 per cent., which for a city of the size of Brussels is phenomenal. The result is ascribed to the extended use of gas for cooking and heating. Brussels has long had the system of differential prices upon trial; but although the various orders of consumption are classified under many headings, there are really only two prices charged—namely, 14 c. per cubic metre, or not quite 3s. 2d. per 1000 cubic feet, for "night gas," and 10 c. per cubic metre, or about 2s. 3d. per 1000 cubic feet, for "day "gas" and all supplies to the municipal offices and establishments, gas-engines, stoves, &c. These are very fair prices for the locality; and the good people of Brussels have reason for thankfulness that, in respect to the gas supply at least, Paris is not the capital of Belgium. The Brussels undertaking has felt the pinch of bad times like others; but it is getting through them satisfactorily, the cost of coal per ton having fallen from 22 frs. 50 c. to 20 frs. 7 c. The administration have also taken to making oil gas instead of carbonizing cannel; and they are creating a market for their breeze by working it up into briquettes. The low percentage of 3·26 for unaccounted-for gas shows the quality of the management, which is in the hands of M. Aerts. Altogether, the Municipality of Brussels may fairly be congratulated upon the show made this year by their Gas Department.

The Inspection of Internal Gas-Fittings at Leeds.

According to the practice of Parliament, a special report has been issued upon those clauses of the Leeds Corporation (Consolidation and Improvement) Bill which propose to confer powers "in deviation from, or in excess of, the general law;" and among these we notice a provision as to the inspection of gas-fittings in new buildings, which, if properly worked, might prove a useful protection to the public. The text of the clause will be found elsewhere. It requires every person who proposes to fix gas-fittings intended to be covered over in new buildings to give 24 hours' notice to the Corporation before such pipes are so covered, in order that a duly-appointed officer of the Corporation Gas Department may test them. This officer is to have power of entry for the discharge of his duty, and also to prohibit any arrangement likely in his opinion to occasion danger or the escape of gas. If reasonable satisfaction is denied to the officer, or if notice is not given of the new pipe fitting, the Corporation may refuse to turn on the gas. When the clause was brought before the Police and Sanitary Regulations Committee, to whom the Bill was referred, it was objected to generally by the Local Government Board, but was supported by Mr. Harrison, the Town Clerk, who stated that it had been found desirable, in the interests of occupiers, that the Corporation should have a right to see that the gas-fittings put into new houses are of a proper and sufficient character. After some argument, in the course of which, curiously enough, no mention was made of the additional responsibility which powers of indoor inspection must entail upon a Corporation, the Committee agreed to accept the principle, on the limited ground that gas is supplied to workmen's houses in Leeds, and that waste and danger arise from the present system. The Chairman appeared to think that there is something exceptional in the fact of a working-class consumption of gas; but this mistake was allowed to pass uncorrected. Something ought to have been said on the point of responsibility. It is true that the clause as it now stands merely says the Corporation "may" inspect; but there have been plenty of instances in which the Courts have held that "may" means "shall" when exceptional powers are in question. The judgment given by the House of Lords in a celebrated case was to the effect that suppliers of gas must be supposed to have cognizance of the destination of their product after it has passed the consumer's meter; and this new Leeds clause appears to strengthen the gas manufacturer's interest in the proceedings and circumstances of the consumer.

Cooking by Electricity.

There has been an amusing little controversy of late in several technical journals respecting the possibilities and prospects of cooking by electricity as compared with gas; and the public have been bidden, metaphorically speaking, to take part in a feast prepared by the most "scientific" agency and apparatus known to civilized man, and to abandon the crude arrangements of the ordinary kitchen in favour of certain pretty little doll's-house fittings brought out in a playful moment by Messrs. Crompton and Co. The gentleman who first attempted to make out a serious case for electrical cooking blundered in the matter of confusing quarts of water with pints; but what of that? Shall not French measurement be permitted to the electrical *chef* as well as to his colleague who attends to the street-lighting department? Mr. Thos. Fletcher was, of course, soon "down upon" the electrical cooker with his pointed criticisms; but it is funny to see how, even in this purely imaginary field of utility, the electrical experts disagree with one another. Mr. H. J. Dowsing speaks for the Crompton toys; only to be pulled up by Mr. G. Binswanger, who asserts that the American and Crompton methods are all wrong, and is in his turn corrected by another firm, who declare that "an ordinary "incandescent lamp" is the best electrical heater that can be devised. And this statement comes upon the oft-repeated claim that the incandescent electric lamp is a source of light practically without heat! The public will get sadly puzzled if this sort of thing goes much farther. In all humility we venture to suggest that some unquestionable authority in electrical matters, such as Mr. W. H. Preece, should take the subject in hand, and straighten out the facts. Mr. Preece used to travel with a doll's house with which he was in the habit of playing nightly, to the delight of crowded audiences, whose intelligence was presumably just equal to grasping the significance of such an illustration of the convenience of electric lighting. If the distinguished Engineer and Electrician to the Post Office were to bring out his toy again, with a kitchen attachment capable of boiling an egg before the eyes of a lecture audience, the suitability of electrical currents for doing all the work of cooking a family dinner would be established.

Mr. W. Lloyd Wise on Patent Law Reform.

The subject of Patent Law Reform is one of the topics that are always with us; and consequently attention may be profitably directed to some suggestions in this regard

recently offered by Mr. W. Lloyd Wise, Fellow of the Chartered Institute of Patent Agents, for the consideration of the Associated Chambers of Commerce. It is gratifying to find that this competent authority in patent practice is in substantial agreement with our own views, and is at one with us in deprecating changes in the patents system of this country in deference to the hastily-formed opinions of dabblers in this matter. Mr. Lloyd Wise is no admirer of the American, or German, or any other foreign patent system merely because it is different from ours; and he speaks very sarcastically of the "little knowledge" of those who would change everything in order to follow strange models. Upon the question of Government fees, Mr. Lloyd Wise is of opinion that the present reduced scale should have a fair trial before rushing into a further reduction. He brands as "utterly impracticable" the suggestion frequently made that patent applications should be officially examined, and when granted should be "absolute." The new German law is a step in this direction, inasmuch as it provides that proceedings for declaration of nullity must be instituted within five years from the date of publication of the patent; but even German manufacturers are doubtful of the results of this legislation. As an alternative to the grant of "absolute" protection, it has been suggested that there should be an official search on behalf of inventors. If this means that every application for a patent should be subjected to examination as to novelty, Mr. Lloyd Wise thinks it quite possible that a workable system might be devised. But, as he says, those who talk about the advantages of the examination systems that prevail in the United States and in Germany have yet a great deal to learn. "They evidently have not any "idea of the large proportion of invalid patents that are "granted, notwithstanding the irritating investigations "and the often unreasonable requirements of officials." They are ignorant also of the large number of patents which, after being granted, are declared invalid both in Germany and the United States; and in the case of the latter, of whose patent systems many of the uninitiated seem to be enamoured, "they little dream of the enormous "amount of money that is being constantly spent in liti- "gation concerning the validity of patents." Nor do those who so urgently and blindly demand an exhaustive official examination preparatory to the grant of Letters Patent, know how often this is the actual cause of the refusal of patents for meritorious inventions which happen to be unintelligible to the official mind. These caustic observations of Mr. Lloyd Wise appear to be directly aimed at that curious organization for Patent Law Reform which had its centre in Liverpool, and which imposed its programme upon a number of Lancashire candidates for Parliament at the last General Election. Mr. Lloyd Wise is of opinion that the most effectual mode of weeding out impracticable and unworkable patents—an admitted necessity, of which the United States patent system is deficient—is by making all patents subject to annual payments. These need not be large—the sum of £2 per annum after the first four years is named as probably sufficient. Mr. Lloyd Wise evidently thinks that in time the charge for a fourteen years' patent might advantageously be reduced to £25, payable by instalments; but in the meantime he would probably admit that the Patent Office might do more for patentees and the public, and be a more convenient establishment than it actually is. Things will be better when the new buildings are completed.

WATER AND SANITARY AFFAIRS.

THE report of the Special Water Committee of the London County Council, recommending that a Bill should be introduced in the session of 1894 to provide London with a supplementary supply of water, has suddenly collapsed; being withdrawn at the meeting of the Council last week. The confident tone of the report is in singular contrast with this "lame and impotent conclusion." The Committee apparently entertained the fullest expectation that their recommendation would be adopted; and they described themselves as "using every effort to collect the "materials" for a comprehensive scheme to be embodied in the coming Bill. They also hoped "to present a further "report soon after the recess;" the one already brought forward being only "preliminary." The whole affair is now shunted off the line—thus leaving the road clear for the report of the Royal Commission. Whether the withdrawal is due to a feeling of respect for the Commission, or whether the Committee find that the preparation of a plan for providing a supplementary water supply for the Metropolis is a more difficult task than they anticipated, are matters on which we are not yet enlightened. But the policy avowed by the Committee, and recommended to the Council, was, in some way or other, to prevent the Water Companies from obtaining capital to enlarge their works, so as to provide a supply equal to the growing demand. The Council are thus advised to set themselves against any increase in the flow of water into London, unless the Companies can be ousted from the scene. What the Royal Commission may have to say on the subject is now a matter of very special interest. The coming sitting, which we mentioned last week, has reference to the epidemic of enteric fever which visited the Tees Valley in 1890-91. The connection with the London supply is rather remote.

What would be said in London, and especially at Spring Gardens, if the Metropolitan Water Companies were to announce that in seventy days their reservoirs would be emptied, and the supply of water would have to be seriously curtailed, unless rain fell copiously in the interval? Yet such is the present position of Manchester, despite the preparations for bringing water from Thirlmere. The Mayor of Birmingham has also issued a cautionary notice, urging strict economy in the use of water; the available sources being greatly reduced by the drought. The Local Board of Nantwich "have only "a visible supply of water" for the same period as Manchester; and they are appealing to the inhabitants to be careful in their use of the supply—proceedings being threatened against any persons wasting water. Plymouth is in straits; and a water famine appears imminent. London, with its enormous population, together with the environs, suffers no stint. No Metropolitan consumer expects to find the supply run short; and a constant service is given to 70 per cent. of the houses. Yet the public press offers no congratulation upon so valuable a guarantee for the health and comfort of above five millions of people. That the supply is not only abundant but good, is proved by the scientific reports which are published every month, giving the fullest particulars as to the character of the water.

Threatened interests, like threatened men, frequently obtain a long lease of life. The truth of the proposition is well illustrated by the position of two Water Companies in the South of England. At Portsmouth and at Chichester, the purchase of the water-works in each of those towns has been mooted from time to time in the course of the last decade. But the works have not yet changed hands; and, although the longest lane must have a turning, it may be that neither in the naval port nor in the cathedral city are the Local Authorities yet within measurable distance of the goal at which they have sometimes gazed with longing eyes. As regards Portsmouth, while the Town Council have been gazing, the prosperity of the Water Company has been growing, until now, we believe, the Directors estimate the value of the property at something like a round million of money. Waking up to this fact, the Portsmouth Corporation have just exhibited another spasm of activity. Last week, a new deputation of councillors met the Directors of the Company; but whether energetic negotiations will now be pursued, or whether there will be another interval of a year or so, followed by yet another palaver, is more than anyone can undertake to say. Meanwhile, the shareholders have the satisfaction of receiving their full statutory dividends, with the additional advantage of accumulating by slow degrees a fund for meeting dividends which were not paid in former years. Thus, in this instance, the proverbial position is reversed; and while the Corporation allow the grass to grow under their feet, the steed—*i.e.*, the shareholder—finds himself not starved, but quite in clover. Probably they are debating—mentally—the problem to which attention was directed last week in connection with the purchase of the Stourbridge Gas-Works. In a word, ought the ratepayer of to-day to be called upon to bear an extra burden in order that those who come after him may enjoy a benefit? From an altruistic point of view, it is well and fitting that a public body should look beyond the

immediate present, and contemplate the needs and advantage of a generation yet unborn. But against this lofty principle of conduct there arises a counteracting influence of no mean weight. "After all," says the local wire-puller, "one has to live in the present. What if the rate-payer of to-day should scout my scheme, and turn me out of office? A live donkey may be more influential than a dead lion, or one that has not yet seen the light." So, between these two considerations, as between two stools, schemes of purchase often fall to the ground, only to be picked up gingerly, and at long intervals, by a newly-nominated deputation full of new-born, but evanescent, zeal. Such, we take it, is the position at Portsmouth. tis a fairly typical case; and it may be noted for purposes of both instruction and amusement.

No less curious is the story of the somewhat similar negotiations which have taken place at Chichester. There, indeed, the water-works question seems to have been the shuttlecock of local factions. A certain party in the Council, known as the "non-drainers," were anxious at one time to purchase the works; their policy being water *versus* drainage. They regarded the alternative expense in the light of a choice of evils. Now, however, that drainage is forced upon them, they desire to wriggle out of their negotiations with the local Water Company. No wonder that, at a recent Council meeting, there was some hard hitting over this record of disingenuousness and inconsistency. After three years' agitation in favour of buying the water-works, the non-drainers try to back out. By way of explaining this strategic movement to the rear, they allege that only now have they discovered that, in order to acquire the water-works compulsorily, the city would have to promote a Special Act of Parliament, and that the Act will cost a dreadful lot of money. Could anything be more fatuous or feeble? But, in trying to escape from the frying-pan, it seems not improbable that the Chichester Council will tumble into the fire. The question has been raised whether it is not too late to draw back from the definite offer of purchase which was made to the Company. That, as the Mayor very discreetly observed, is a question for the lawyers. It must depend on the exact circumstances of the transaction, and upon the stage it reached. One councillor, with an appetite for nice points, flavoured with technicality rather than with equity, asked whether the existing Council were bound by what had been done by the old one. The answer is obvious and crushing. Councillors may come, and councillors may go; but the Corporation aggregate is a continuing body, and cannot repudiate in 1893 anything which it legally bound itself to do in 1892. Another speaker, with some sense of humour, remarked that the meeting would be memorable if only for the admission that the proposed purchase of the water-works, involving thousands of pounds, was merely a red herring drawn across the trail of the local drainage question. The Company, he said, had been a sort of municipal plaything. No doubt; and, in one form or another, the city of Chichester must expect to pay for the game.

To those who nourish lofty views in regard to providing for municipal control of water-works, what has been written above may afford some unwelcome, but withal practical, information. The principle is one thing; the practice is another. In the provinces, as at Spring Gardens, we see all sorts of petty and preposterous things done in the name of Public Policy. Catchpenny devices for getting hold of other people's property, after industriously cheapening it in the eyes of the public, are not peculiar to London, or confined to that august body the London County Council. Since the late Lord Derby uttered his memorable dictum in the Sheffield case, Public Policy, large and luminous, has been inscribed on the banner of every municipality that has borne down in battle array upon a water company. Yet, as we have said, threatened interests live long. But little real advance has been made along the path of compulsory purchase even now. We have all heard of the Stockton case and the Sheffield case; but there is no instance on record in which Parliament has forced a company to sell works which in all respects meet the reasonable requirements of the districts in which they are established. If such works are coveted by a local body, and it is sought to arrange terms of purchase without recourse to Parliament or arbitration, the buyers must assuredly expect to pay a full price for their bargain.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTIETH ANNUAL GENERAL MEETING,

HELD AT

THE CITY HALL, BELFAST, JUNE 13TH, 14TH, & 15TH, 1893.

DENNY LANE, ESQ., M.A., President.

INAUGURAL ADDRESS.

Seven years have now run their round of days since you conferred on me the distinction of electing me to preside over our Institute. This distinction was no little enhanced by the facts that a body almost exclusively composed of engineers had chosen for its highest official one who was not a member of their profession; and that a society, nineteen-twentieths of whom were Englishmen and Scotchmen, had selected an Irishman to conduct their deliberations—a token, although a small, still a sincere, symbol of that amity which I trust may for ever exist between these different nations. Then I felt not a little proud that, in London, I filled the chair which the Telfords, the Stephensons, the Brunels had as Presidents of a kindred Institution occupied—an Institution which, recognizing our kindred claims, had for many a year opened its hospitable doors for our reception. And now, as if the office of President was like the duration of Parliament, of a septennial character, it becomes my duty to open our proceedings in the industrial capital of Ireland.

When I was requested to accept this office, I was very unwilling to comply, feeling that I stood in the place of others more capable and more worthy; but when I understood that my election was unanimous, and that our meeting was to take place in Belfast, I could not resist the demand that an Irishman should greet you on his native soil, and wish you a hearty welcome when you came to visit "the fair hills of holy Ireland."

In other parts of our island, you will see much to admire in natural beauty—the broad and grassy plains of our fertile midland, the bold cliffs of our coast (some of the highest in the world), the variety and majesty of our mountains, the beautiful courses of our rivers, the sheen of our lakes, embowered in foliage and ferns, nourished by the rains and dews of our humid and temperate climate; but it is only in Belfast and its neighbourhood that you can see any large development of those large industrial enterprises which have done so much to maintain the population and increase the wealth of the sister countries. At a time when the woollen trade of the South of Ireland was suppressed by the jealousy of English manufacturers, the linen trade of the North was fostered until it grew into the position which it has for so long maintained; and the Irish linen trade, the largest in the world, maintained for so many years by the excellence of its quality, has its centre where we are now assembled. The necessity for machinery called into play the energy of a large body of mechanics; not only for its own trade, but for that of the world, the spinning and weaving machinery of Belfast holds the first place. Another spinning industry—the production of cordage—is represented in Belfast by the largest manufactory in the world, and is administered by Mr. Smiles, who has learned from his father, the author of the "Lives of the Engineers" that lesson of "Self-Help" which he so early and so zealously taught. Again, from the dockyards of Messrs. Harland and Wolff and others have been launched those rich commercial navies which count amongst their fleets some of the largest and swiftest vessels that ever swam on the ocean.

In selecting the topics on which to address you, a difficulty now exists which formerly was absent. The search for a subject with which you are not already perfectly familiar, every day becomes more embarrassing, from the fact that so many other societies—not only in London but in the Provinces—have during the course of the year discussed so many questions, and have been addressed by their Presidents on general topics so often, that nearly everything has been anticipated. I feel therefore like one who has arrived too late at a banquet, where all the best viands have been consumed, and only some crumbs of the feast are left to "coldly furnish forth the tables." Besides this you must remember that our meeting is held a month

later than that of the kindred society; so that their able President, Mr. Methven, could gather the first-fruits of the year, and there was left for me only those topics which were turning sere. Indeed, little has been left unsaid on the practical details of our manufacture; and I have therefore thought it better to lead you away from your wonted fields into pastures new. On a previous occasion I took the same course, which seems to have met with your approval, and provoked one of the Continental journals into the most unmerited eulogy.

Within the now waning century, three great developments have taken place—all from their magnitude necessarily co-operative: Gas, railroads, electricity. I am not old enough to have stood by the cradle of the first; but I have travelled on the first passenger railways in England, France, and Belgium, when I believe no others were open in the world. I saw the telegraph at work when it was open only from Paddington to Slough. I saw the earliest glow lamps, and heard some of the earliest telephones. "Once upon a time there was a king, and he had three sons," so begin scores of fairy tales; and gas, the iron-way, and electricity are the three "Princes of the blood" whom the Nineteenth Century has engendered. I need not tell you that the eldest was and is, according to the story-tellers, the worst of characters; the second middling; and the youngest a paragon of all the virtues. Passing over the second prince, whose mediocrity condemns him to oblivion, let us study a little the characters of the vicious heir Gas, and the virtuous *frère cadet* of this Royal house, entitled Electric Light. If the views I present seem too elementary to some of you, I have only to say I do not seek to teach those who know everything already, but rather to give a general view of the subject to such of you as have not had time to see both sides of the shield.

It may be thought that I cherish some prejudice against electric lighting. On the contrary, I have a most friendly feeling towards that mode of illumination; for since its advent, the manufacture in which we are most interested has progressed more rapidly than at any former period. The Company with which I am connected have more than once proposed to the Local Authority to take powers to supply the electric light; but the Corporation has dissented. When properly managed, I believe the light is beautiful and convenient for those who can afford to pay for it; but no better evidence of its costliness can be found than that the west-end clubs of London—the richest and most luxurious institutions in the world—signed not long since a "round robin," complaining of its high price. So far as we are concerned, the new light, instead of being a star of ill-omen, has been the harbinger of success.

The figures I employ have been taken from those given by the electricians themselves. I wish that they would reciprocate this fairness, and, adopting our statements, imitate the "sweet reasonableness" which we proffer to them, and avoid the utterly unfounded statements about gas and its evil behaviour, especially its deleterious effects upon health. I may give one case from my own experience. About fifty years ago, a professional friend of mine had gas introduced into every room of his house. Ten children were born there—the population running sometimes up to 16 persons. But no death took place except one—that of a lady no longer young; and it was never alleged that she was poisoned by gas. The disciples of Malthus should therefore wreck all the gas-works they could reach, if this were generally the case.

The misstatements of some of the advocates of the new light are ludicrous. Several of them assume that we manufacture nothing but gas, and "remember to forget" that the raw material yields—in coke, tar, and ammonia—products which often pay 75 and sometimes 100 per cent. of the prime cost of the coal. Again, they measure the light given by defective burners; but they allow no credit for good ones. If gas be burned in a Bunsen burner, I can show that London gas does not reach a 1-candle standard; and most bad burners are modified Bunsens, in which air is unduly mixed with gas. Again, they assume that an incandescent lamp retains its original power; while it has been proved that a 16-candle lamp declines to 8 candles, and averages only 12 candles. The Board of Trade was over-liberal to the new agent, when it allowed 10 units to be the equivalent of 1000 cubic feet of gas. Practical men say 12 or 13 units would be more correct; and yet these one-sided advocates put down only 6 units as the equivalent.

In a recent paper, on the "Economy of Electric Lighting," that eminent electrician, Mr. Gisbert Kapp, has pointed out that, when glow-lamps are used at the power marked by the makers, it takes $4\frac{1}{2}$ watts to give 1 candle. Indeed, the electricians themselves calculate that the 8-candle lamp requires 35 watts when new, or $4\frac{3}{8}$ watts per nominal candle—a quantity largely increased as the lamps grow older. Now London gas gives per 1000 cubic feet 3300 candles, which, multiplied by $4\frac{1}{2}$ watts, gives 14,300 watts, or over 14 units, without counting cost of lamp renewals, or the serious falling off in light-giving power. Allowing a small sum for the latter item, we may say 15 units are the equivalent of 1000 cubic feet of gas; and at 8d. 15 units cost 10s., as against 2s. 9d. or 3s. When cannel gas is supplied, the contrast would be still more striking—over 20 units to 1000 cubic feet. Mr. Kapp proposes to overwork the glow-lamps, giving them a shorter life; believing that the extra cost of renewals will be more than compensated by the saving in current. These wilfully blind advocates shut their eyes to the fact that a gas-burner may be checked in consumption, while the new lamp must be left full on or quite off—"Hobson's choice; this or none." From counting 16-candle they have come down to 8-candle lamps; and in other small ways they have endeavoured to "whittle down" the comparative cost of the current. These statements often come from men whose names were never heard of in connection with electricity; and the authors of them might be pardoned on the theological ground of "invincible ignorance."

But, amongst them all, the boldest in reckless assertion is one who cannot plead such an excuse—Mr. Preece, the Electrician to the Post Office—a public official receiving a public salary as head of the Telegraphic Department. He has become the adviser of corporations and private companies, and the competitor of independent engineers who are not paid from the public purse. I will give you one example of his dignified style, taken from his inaugural address delivered to the Institution of Electrical Engineers last January. He says: "If a full load could be maintained during the whole 24 hours, electrical energy could be manufactured for one-third of a penny per supply unit, which is equivalent to gas at 2d. per 1000 cubic feet. The potentiality of economy in electric lighting is thus beyond the dreams of the *gasman*. The most marked features in the development of this great industry are the ostrich-like blindness of the gas manager, who buries his foresight in his fat dividend, and the childish wailings of the gas technical journalists. The gas industry should itself have nursed the herculean infant who is rapidly strangling its main sources of profit." As one-third of a penny per unit is under a farthing per horse-power, I can promise Mr. Preece to maintain his full load during the 24 hours when he is prepared to supply power at that rate.

"Save me from the evil spirit," exclaimed Paul Louis Courier, "and from *metaphors!*" Here in a small segment of a short paragraph you appear, gentlemen, as "dreamers," as "ostriches," as "puling babies," and as the "snakes" that the infant Herakles strangled in his cradle. But not only are these threadbare metaphors mixed one with t'other, but they are combined with the most ungracious language. You can determine how far it is consistent with the dignity of a gentleman, the culture of a scholar, or the *esprit de corps* of an engineer, to employ towards those whom he should regard as members of a kindred profession, terms which if meant for wit are devoid of humour, and if intended as contemptuous recoil on him who fell low enough to use them. The dignified periods of Samuel Johnson are combined with vulgarity; and if hereafter his dignified and potent shade will meet that of the Mercury of the English Post Office in Elysium, it will no longer be Elysium for the latter.

Mr. Preece proceeds to say that the "electric light is essentially the poor man's lamp," although I have already told you that in the district most densely packed with palatial hotels and luxurious clubs, which use the light for the longest hours, this poor man's lamp has been found too expensive for the very capital of clubland.

I will, with your permission, give some specimens of the "potentiality of wealth beyond the dreams of avarice," which Mr. Preece promises to those who embark with him on his voyage to El Dorado.

I will merely mention in passing the London Electric Supply Corporation; but it would be unjust to reasonable

electricians to compare their schemes with that of Mr. Ferranti. By Mr. Field's tables, the income of the three London Gas Companies is £4,724,000; while the capital is only £15,144,000, or three and a half times their annual revenue. The gas capital employed by eight large cities supplied by corporations is £8,015,000, or a little over four times their income of £1,978,000. Ten large provincial companies receive annually £1,725,000; while their capital is only £5,756,000, or three and a quarter times their revenue. The London Electric Supply Corporation in 1892 had an income of £24,282, with a capital of £836,000—equal to 34 years' revenue. This income, instead of increasing, was £4400 less than that of 1891; and the expenditure exceeded it by £3914, leaving a loss of this amount. Of the current generated, 58 per cent. was wasted in mains and transformers—leaving only 42 per cent. at the consumers' meters. But the distribution is now to be amended under the skilful guidance of Dr. Fleming; and the Directors hope that the "unaccounted-for" current will be reduced to 30 instead of 58 per cent. But even this reduced amount looks formidable enough to the eyes of a gas engineer. As a specimen of waste, I may mention that the outlay on instruments alone (exclusive of meters and transformers) was £12,000—not far from a half-year's income—which would be much the same as if the Chartered Company were to spend £1,500,000 on pressure-gauges, governors, photometers, &c. I think I may promise for Mr. Methven that he will not advise such an outlay.

I sincerely regret the evil fortune that has attended this great experiment, which seems to have been dogged by ill-luck from the commencement; but, even under the most favourable circumstances, success could not be expected for a design planned on such extravagant lines. It may have been "magnificent," like the Balaclava charge, but it was not a serious campaign. Mr. Ferranti—the general who set the squadrons in array—seems to have exercised a spell like witchcraft over the first Board of Directors. Now, under the financial management of Mr. Staats Forbes, I trust the affairs of the Company may improve, especially as at Deptford he is seconded by Mr. D'Alton, an able practical engineer, who has already introduced valuable improvements, and has, moreover, the crowning virtue of being an *Irishman*, of a lineage which, to judge by my own experience, will not be without its value in your eyes.

But dismissing, for the present, this case of wild extravagance, let us see what the average result of such investments has been. That Cyclopædia of Science called the "Electrical Trades Directory for 1893," so admirably brought out by the publishers of the *Electrician*, is the latest authority I can refer to; but, as the campaign of 1892 was not closed when it was compiled, I must take the profits of the year 1891. From October, 1878, to 1882, 56 companies were floated, with a total capital of nearly 21 millions. More than half of this was paid up, and nearly all has been lost. At the close of 1892, the electric light companies of the Metropolis had a capital of £5,250,000, of which £2,700,000 had been paid up. The total profit for 1891 was £25,000, or less than 1 per cent. At the same time the electric manufacturing companies had a capital of £4,750,000, of which £2,700,000 had been called up, and earned a profit of £211,000, or nearly 8 per cent.—a fair, but still moderate profit on a fluctuating business. I have excluded the Edison-Swan Company, who only make lamps, and the Woodhouse and Rawson Company, which declared a dividend of 15 per cent., and were practically bankrupt the year after.

I will give an example of a town where gas and electricity have been in competition for over ten years—Eastbourne—which has therefore the benefit of accumulated experience—an experience so valuable that the officials of the Electric Company wish to keep it all to themselves, for they have refused to give a copy of their balance-sheet to a ratepayer who had contributed his quota to the public lamps which they supplied. This was a foolish attempt to conceal what could not be hidden. The total capital of the Company amounts to £37,000, of which only £400 is preference, on which, I believe, a dividend has been paid for some time; but this year the ordinary shareholders have for the first time been accorded a dividend. Charging 9d. per unit. the balance of profit and loss is £431, of which £233 is brought forward from a previous account; leaving the annual profit £198. But £169 of this arose from the sale of fittings; and £25 was received for a pupil's fee. If these two sums be deducted, we find the profit on electric lighting amounts to £4, for earning which the Directors justly received £250—too small a remuneration, when we consider the anxiety of mind caused by trying to navigate a craft so unseaworthy amidst shoals and breakers. They are now calling for more capital to be invested in this mine of gold, this "potentiality of wealth beyond the dreams of avarice," as Mr. Preece calls this "great industry." Why do the Directors not ask him to devote some of the abundant leisure which he has to spare from his official duties, and by his divining-rod find this hidden vein of gold into which they have not yet sunk a shaft? In this same town of Eastbourne, when the electric light was started in 1882, the consumption of gas was 99,584,000 cubic feet; in 1887, 146,068,000 cubic feet; and in 1892, 207,036,000 cubic feet—an increase of 107,452,000 cubic feet, or over 107 per cent. Thus was this "spotted snake" strangled by the "Herculean infant." An old Cork rhyme runs thus:

> It is better to fall with your back in a set of furze,
> Than venture to play with those ticklish things *metaphors*—

rhyme *and* reason which I commend to Mr. Preece. I may remark that this Engineer has recommended the Corporation of Bristol to charge 6d. per unit; being 1800 per cent. over what he says electricity could be supplied at "if the load factor was uniform."

It is, I think, Mr. Crompton who first invented the very useful term *load factor*—meaning the ratio between the average and the maximum delivery of electricity. Of course, gas engineers have a load factor of a somewhat similar kind, but their system of storage enables them to put by the surplus of the day production to help the hours of darkness. With the alternating current, no storage is possible; and hence, if the dynamo ceases to work for even a few seconds only, all lights are extinguished. With the continuous system, accumulators afford a partial but a very expensive and wasteful remedy. If we put 100,000 feet of gas into a holder, and got only 85,000 feet out, we should say things were going on badly. Yet this very bad result is the very best claimed for storage cells, and in some cases the loss, I believe, is 40 per cent. The lot of the gas manager is also made more easy by the fact that a large percentage of gas is used by day for heating, cooking, motive power, and manufacturing purposes, thus filling up, to some extent, the deep hollow of the electric diagram. The sudden rise and the sudden fall of the curve, produce the greatest difficulty which meets any system unprovided with storage power. Indeed, some of the statements under this head are startling. Professor Unwin states that within the 24 hours the demand varied from four times the mean to one-twentieth of the same quantity—that is to say, that the maximum was 80 times more than the minimum output. Even in gas distribution, the maximum is 50 times as much as the minimum hour.

The latest authority is Professor Ayrton, who, in his monograph prepared for the British electrical section of the Chicago Exhibition, states that the average hours of consumption of the electric light in private houses is only 1 hour in the 24, in shops and flats only 1½, and that it is only clubs and theatres that exceed this limit. Let us see the result that this leads to. He says that the whole of the electric lights fixed in Great Britain are equal to 750,000 8-candle lamps. Allowing even 800,000 lamps, this would be equal to 400,000 16-candle lamps; and allowing even 1½ hours would mean 600,000 lamp hours, which could be supplied by 600,000 × 5 = 3,000,000 feet of gas a day, or equal to 1100 million feet of gas in the year. This is less than the Brentford Gas Company sells. The town of Nottingham consumes more; and the combined consumption of Plymouth and Portsea is considerably more. The total sales of gas in London are 30,000 million cubic feet. The annual increase lately has been about 6 per cent., or 1800 millions; so that the increase of gas consumption in London alone in one year would give one-and-a-half as much light as the whole electric lamps of Great Britain.

If we were situated near the Equator, the variation of the days would not be so great; and if we worked at night and slept by day, the load factor would be much more convenient for us all. Or if we lived near the North Pole, we might work our dynamos for half the year, and let them sleep beneath the midnight sun for the other half. But placed as we are, where the seasons' change is so wide this load factor becomes a burthen indeed. Make the case your own. Suppose that you had no gas storage,

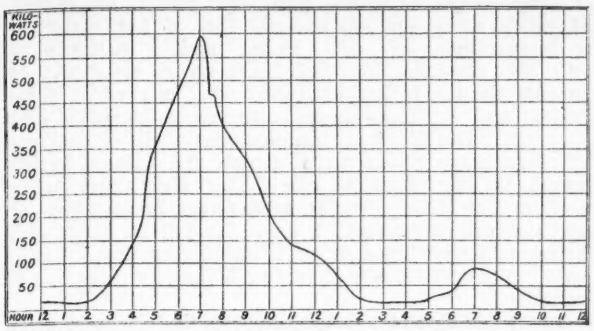
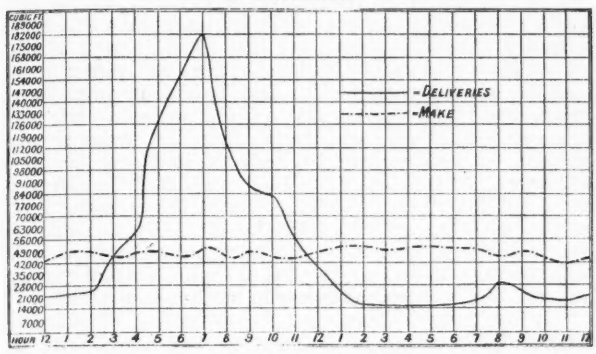


DIAGRAM SHOWING ELECTRICITY SUPPLIED FROM A CENTRAL STATION IN MIDWINTER.



Gas made in 24 hours, 1,174,000 cubic feet; do. delivered, 1,263,000 cubic feet.

DIAGRAM SHOWING MAKE AND DELIVERIES OF GAS FROM THE CORK GAS-WORKS ON DEC. 23, 1892.

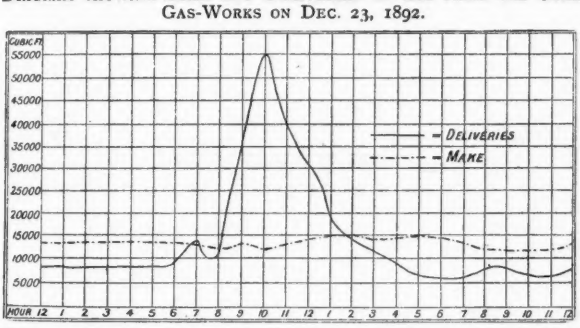


DIAGRAM SHOWING MAKE AND DELIVERIES OF GAS FROM THE CORK GAS-WORKS ON JUNE 22, 1892.

then in the lightest hour you should have as many retorts heated as may be required for the supply of the heaviest possible demand—for it is the *maximum hour's* consumption you should be prepared for; and in many cases the electrician has practically to provide, not for the maximum hour's, but for the maximum minute's output.

I have said that, besides the great aid that you derive from storage, your load factor is greatly alleviated, and your feelings soothed, by the fact that every year the "day" consumption of gas for heating, cooking, power, and other manufacturing purposes increases, while the lot of our younger rival is not yet made happy by such consolatory aids. Mr. Methven, in his recent interesting address, has shown that in the district of the Chartered Company the consumption of gas from 6 a.m. to 6 p.m. has been 37 per cent. of the total; and in other London districts, a little under 30 per cent. Of course, we have heard of electric cooking, and I have seen the amusing experiments on this subject; but this and electric heating are reserved for that happy class "who have more money than they know what to do with."

Mr. J. Ferguson Bell, of Stafford, gives the following as the respective costs of 1 million heat-units:—

Gas at 2s. 3d. per 1000 feet . . .	40d.
Electricity at 4½d. per unit. . . .	.1301d.

The latter being 32 times as dear as heat produced by gas. Electric motors for very small powers will, I expect, come into use; but for anything above ½ or 1 horse power, it is not likely that people will pay a price so much higher than gas power costs. On this subject I again refer to the authority of Mr. Bell, who gives the following figures:—

Cost of gas power at 2s. 3d. = 0·675d., say, ⅔d. per h.p.
" electricity " 4½d. = 4·500d. per h.p., or, say, 6⅔ times the price of gas power.

Let us now examine what modes have been proposed to get over this difficulty; and, at the outset, it is as well to say that no plan has ever been devised to store electricity itself. The garnering up of other forces forms the only mode of meeting the difficulty of the fat kine and the lean kine—of the brief harvest, and the long winter. These forces have afterwards to be transformed into electricity.

First—to begin with the storage cell—no electricity is stored there. It is chemical energy which is laid up. If I take a piece of carbon and a piece of zinc, connected by a good conductor, and place them in an acid, well conducting, and easily decomposed liquid, the zinc will first be oxidized; and the oxide so formed combining with the acid will form a soluble salt. When the zinc has all been dissolved, I place a second carbon in the solution and send through it a current of a strength sufficient to decompose the salt, when the metallic zinc will abandon the acid and be deposited on one of the carbons, leaving the free acid in solution. We have, therefore, what we began with—zinc, carbon, and an acid solution; and, connecting the zinc and carbon as at first, we begin the series again, and repeat it as often as we like, the zinc being alternately oxidized and deoxidized. This is precisely what occurs in the so-called storage battery. The lead compounds are alternately deoxidized and again oxidized; thus alternately absorbing and evolving a current. In both the cases referred to, the oxidation of the metal produces a current; and then an independent current produces deoxidation. As far as I can recollect, Sir William Grove, to whom science owes so much, was the inventor of the first storage system, which he called a "gas battery." A current was passed through two platinum plates and decomposed water—in fact, deoxidized hydrogen—the hydrogen and oxygen being collected in separate tubes. The battery wires were then removed, and the two platinum plates connected by a wire passing through a galvanometer, when a current was observed to be produced by the reoxidation of the hydrogen and the reconversion of the gases into water. Gaston Planté discovered that, by alternate oxidation and deoxidation of plain lead plates, similar effects were produced. Then came the innumerable forms of the Faure-Sellon process, in which the lead plates were "pasted" with oxides of lead already formed. Yet I believe that, taking into account durability, no system has yet been invented better than the original Planté process, still surviving in the Howell-Crompton and other systems of accumulators. I have said so much in order to show clearly that in these cells there is no storage of electricity. Indeed, it would be wonderful if any prison could be designed to confine a spirit, not "airy," but far more subtle—in fact, "ethereal." As electricity has even disdained the chain of a definition, it does not seem likely that it will be "cabined, cribbed, confined" in any material cell. It passes the wit of man to devise the cunning cage that could confine such a wild bird. These storage cells are undoubtedly often of great use in supplying a small output during the hours of lowest consumption, leaving engines and dynamos at rest for many hours. They are also of use during the hours of heaviest duty, and particularly in steadying the current when the dynamos are running. They are, however, enormously expensive, and occupy a very large space; and I believe there have been explosions caused by the hydrogen evolved. Mr. Kapp, in his lecture at the Society of Arts, puts down their prime cost at £40 to £50 per kilowatt; and as 1000 cubic feet of gas are equal to 30 kilowatts, we have thus £1200 to £1500 for storage, as against £12 10s. for gas. Mr. Kapp referred to comparatively small plants; and I believe for large central stations, the capital would be less. But even if it were reduced to half, the cost of electric storage would be still 50 to 60 times as dear as gas storage. In addition, the depreciation is very heavy, and, with wear and tear, maintenance, and interest, would sum up to 15 or 20 per cent. Their disadvantages are fourfold—

(1) Heavy outlay on capital.
(2) Very large space occupied.
(3) Heavy cost of maintenance.
(4) Loss of current, which, in the most favourable circumstances, amounts to 15, and is often over 40 per cent.

They can never be used economically, except as auxiliaries—a kind of very heavy dragoons, to guard the flanks of the main column.

Two other modes of storage have been recommended

by very eminent professors; and nothing can more clearly emphasize the difficulty to be encountered than the fact that systems so complex, so expensive in construction, and so wasteful, should be even thought of.

Professor Forbes, having to deal with the case of Edinburgh—a place possessing for such a system natural advantages such as no other city in the British Islands enjoys—proposes to pump water for all the 24 hours, if necessary, to a reservoir situated at a great elevation, thus storing the potential energy of the elevated water. The water so stored is to actuate during the lighting hours turbines driving dynamos to produce the current. The natural advantage which Edinburgh possesses is this—that within 1½ miles of the city it has, on Arthur's Seat, a natural reservoir at an elevation of 800 feet, and the capacity of this reservoir can be extended. As it exists at present, this reservoir can hold sufficient water to supply 1000-horse power for two hours.

For motive purposes, the efficiency of a reservoir is the product of two factors—vertical height and capacity—the number of foot-pounds got by multiplying the elevation in feet by the number of pounds of water stored. Some strange mistakes have been made on this subject, and owners of water power have imagined that they have had what they called "a fine ponding power," when it really has been of very small amount. A good many years ago I devised the following very convenient formula, which some of my friends have associated with my name. In it I have assumed that the efficiency of the water motor is 75 per cent.—a very fair allowance when losses by friction, part-gate, &c., are taken into account. The formula is this: "One acre of water, one foot deep, gives one horse power for one hour for (each) one foot of fall."

This tells us at a glance how large the impounding reservoir must be unless the elevation be very great. Professor Forbes has therefore at Edinburgh the unusual good chance of a ready-made reservoir at a very great elevation, and very near the city. Yet, under these circumstances, let us see what the losses may be, independently of the fuel used by the engine which drives the pumps.

First the efficiency of the pumps themselves (including leakage of valves) cannot, I suppose, be higher than 85 per cent.; friction of rising main, which, being continuously at work, may be of smaller dimensions than the falling main, may cause a loss of 10 per cent.; for delivery main, say the same; efficiency of turbine, 75 per cent. Of course, I do not take account of efficiency of dynamo, which would be the same as if it were driven directly by steam-engine. The ultimate efficiency would, therefore, be $\cdot 85 \times \cdot 90 \times \cdot 90 \times \cdot 75 = 51$ per cent. We should also count for interest and depreciation, say, 15 per cent. on the pumps and turbines, and 6 per cent. on the mains, and 5 per cent. on any outlay required for the extension of the impounding reservoir, besides rent and cost of "way-leave."

Against this, the economies would be the cost of smaller steam-engines (worked, however, for longer hours), and the saving of fuel lost in getting up and letting down steam. We have also to look to the additional contingencies which arise under this system. The bursting of a main, the break-down of the pumps, the sticking of a valve, the choking of the turbines—any one of these events would stop the supply of light. Even in the very favourable position of Edinburgh, I cannot see that this system commends itself to engineers.

The latest proposal is what is called "Thermal Storage," by which it is intended to store heat in the form of water, under very high pressure, in strong wrought-iron vessels—in fact, auxiliary boilers without fires—which would be stocked with water heated by other ordinary boilers working all the 24 hours. This project has been devised by Mr. Druitt Halpin, and is spoken of rather favourably by Professor Unwin. In the case of a central station, it is stated that at mid-winter 2000 effective horse power were required to meet the maximum demand, and ten large boilers should be provided; whereas, if the heat could be stored, three similar boilers working for 24 hours would be sufficient. Mr. Halpin proposed to store the heat generated in the three active boilers in 24 wrought-iron vessels, 8 feet in diameter and 30 feet high, raising the temperature to 406° Fahr. At the time when the thermal storage was partially exhausted, the temperature fell to 347°, to be raised again to 406°; and it was calculated that, with this range of temperature, 16 lbs. of water would furnish 1 lb. of steam at 130 lbs. absolute pressure. Taking 18 lbs. of steam per horse power, we should, therefore, store up $18 \times 16 = 288$ lbs. of hot water at a temperature of 406° Fahr., and a pressure of 265 lbs. absolute, for each horse power required. At present the ten boilers used cost £10,300; while three boilers and 24 high-pressure storage tanks would cost £15,000. But if by the arrangement ½ lb. of coal per effective horse power were pared, the annual saving would be 1270 tons of coa This shows the power consumption to be 5,689,600 horse power hours a year, or 15,600 horse power hours a day. Now if we divide this by 2000 effective horse power, it would seem that, in mid-winter, the demand was equal to 8 hours of the maximum capacity.

I may add that Mr. Halpin suggests that the waste heat escaping from our retort-benches might be utilized for heating the water in his storage tanks; and, taking the escaping furnace gases at 1200° Fahr., he estimates that the quantity of heat passing away into the chimneys of our gas-works would supply 30,000 effective horse power night and day all the year round. But I think he must have taken our temperatures, and felt our pulses, before the regenerative system had been adopted; for, under such a system, no temperature so high as 1200° reaches the chimney. At the same time, I believe that, if the draught were not too much impeded, some of the escaping heat might be picked up and utilized. Mr. Halpin estimated that it required 319 lbs. of coke to carbonize a ton of coal, or more than 14 lbs. per 100 lbs. of coal. This, of course, exceeds the quantity necessary in best modern settings.

To the complications and heavy initial expense of Mr. Halpin's system, some addition may be requisite on account of working for 24 hours instead of 6 or 8 hours; but the proposal puts an additional grave accent over the already sufficiently grave difficulty of the load factor.

Now the question arises, Is there any possible solution of this question? I answer at once that there is an easy and a ready solution; and that solution, gentlemen, is in *your* hands. Instead of storing chemical force in accumulators, water at a great elevation, or water at a very high pressure, store *gas*, employ it in gas-engines, and the question is solved. Years ago I proposed this as the most economical system of supplying the electric light; and I was greatly gratified to find that so high an authority as Professor Kennedy has lately recommended the same system to the Corporation of the City where we are now assembled. Let us see what capital will be required. For six months of the year, every well designed gas-works has storage to spare; so that we have to provide additional gasholder room for the winter only. Under ordinary circumstances, I suppose I may put down the cost of a gasholder at £12 10s. per 1000 cubic feet; and charging 8 per cent. for interest and depreciation, this will come to about £1 a year. If filled and emptied 240 times a year, the cost of storage would be only 1d. per 1000 cubic feet, or if filled 120 times—or, say, once a day for four months—the cost would be 2d. per 1000 cubic feet. What will these 1000 cubic feet do? At 25 cubic feet per effective horse power, or 33⅓ feet per kilowatt, we get by means of a gas-engine 40-horse power, or 30 kilowatts, for a cost of 2d. for storage. So that, supposing you have to put up a new holder for the purpose, the outlay would be one-fifteenth of a penny for every Board of Trade unit. But I go further, and say that this storage costs less than nothing, if you take into account the cost of attendance on steam-engines, boilers, price of water, carriage of coal into and ashes out of a central station, and the cost of chimney shaft, setting, and repairs of boilers. But the heaviest loss is in the fuel wasted in getting up steam after several hours' rest of the boilers, and the waste of heat if the fires be banked for 20 hours out of the 24. On the other hand, the gas-engine can be started in a few seconds, and there is no waste in the "hours of idleness." Here, then, we have under our own hands the most effectual and cheap system for immediately supplying fuel when wanted, and restoring it in the frequently recurring intervals.

Having disposed of this difficulty, I come to another obstacle in the way of electric progress—viz., the cost of conductors. As long as overhead high-tension conductors were allowed, the difficulty was not so great. But since the Board of Trade nearly always requires underground conductors, the cost has been greatly enhanced, and two systems have been adopted—for the low-tension system, bare copper rods laid in concrete culverts; and for both

low and high tension, insulated cables, generally drawn through cast-iron pipes, which are sometimes filled with oil. Both of these modes are very expensive; and this has led to the transformer system, which is the most important development that has taken place during the last dozen years.

The transformers are of three totally different kinds, as they are to be used by the continuous or alternating current. In the first case, the transformer consists of an electric motor made to revolve by the current; the same axis carrying a dynamo, the revolution of which in a magnetic field generates a current of lower voltage. In the first step, the electricity is converted into motive power, which is again converted back to electricity. The first may be a current of high tension requiring a cheaper conductor; and the secondary current may be of the lower tension used in electric lighting. As in each of these conversions we get out, say, 86 per cent. of what we put in, the result is about ·86 × ·86, or under 75 per cent. of the originating current, without counting the loss in the primary main. For the low-tension system, another plan has been used—viz., four sets of storage cells are charged in series by an originating current of (say) 400 volts, until each set can give a tension of 100 volts. They are then disconnected from the charging mains, and discharged separately through the service mains at 100 volts. The object of the whole arrangement is to diminish the cost of the conductors in the ratio of over 3 to 1; but the heavy loss incurred by storage cells, their great cost, and rapid deterioration, are inseparable from this system.

As a motor actuated by an alternating current has not yet come into practical use, another device has to be resorted to, the germ of which, as well as of those of many other inventions, is to be found in Faraday's earliest papers on the subject. Taking a soft iron ring, he wound on different parts of it two coils of insulated copper wire. On making or breaking a battery current through one of these coils, a momentary current was produced in the other. The alternate current transformer of the present day consists essentially of the same parts—viz., a soft iron core wound with two coils; one of thin wire through which the original alternating current is carried, and the other of thicker wire through which a current of lower tension is generated fit for electric lighting. A common proportion is 2000 volts reduced to 110 volts.

Now the only object of all these transformers is to diminish the cost of the conductors from the central station; and the relative cost of conductors depends on this principle. What the electrician sells is a watt; but the watt, like the foot-pound (to 44 of which it is equivalent), is a compound unit, being the product of the volt and the ampere. To secure a given product, we may make one factor very small by making the other very large—1 lb. falling 1000 feet is the equivalent of 1000 lbs. falling one foot. Now the heating of the conductor, and the dissipation of energy as heat, in no way depends on the volts, but altogether on the ampères being proportional to the square of the ampères, multiplied by the resistance. Small wires offer more resistance than large ones; and to secure a sufficient number of watts through them, we must increase the volts and lessen the ampères, which alone cause the heating and loss of energy. The whole object, therefore, of these systems is to diminish the cost of the conductors; and it seems now to be generally agreed among practical men that it is not economical to send more than 1000 ampères per square inch as the maximum current that a copper conductor can safely carry—a quantity which at 100 volts would supply about 750 16-candle power lamps. But I find that Mr. Crompton, in his celebrated paper on the relative efficiency of alternate current and battery transformers, allows only 720 ampères per square inch. Mr. Crompton says that a double conductor, each of 1½ square inches section, shall be used for 1080 ampères. At 110 volts, it requires about 7 ampères for a horse power; so that the 3 inches of copper gives only 154 horse power. It would, therefore, require two sets of these double conductors to deliver as much power as a 6-inch gas-main could carry; and the cost, instead of £500 or £600, would now run up to £1100. If the gas-pressure was increased to 16 inches, the corresponding electric conductors would cost £22,000. If the alternate current is employed, the insulated cables would, by Mr. Crompton's calculation, cost 2·63 times as much. Besides this, there would be considerable loss of electricity, and practically none of gas, in a main laid specially for the purpose and not tapped for service-pipes.

But this change of tension cannot be effected without loss. My friend, Mr. Mordey, appears to have been very successful with the closed, while Mr. Swinburne advocates the open Hedgehog transformer. What the loss is, I would be afraid to say; but it used to be laid down that these transformers had a high efficiency when on a full load, but showed great loss at low loads. Originally each house was supplied with a separate transformer. Now, I believe, the transformers are "banked," using a large number, or those of large size, for the heavy hours, and a smaller number for the light hours. I must say I am rather surprised at the high yield claimed for some of them; and I should like to see some reliable return of the number of watts put into the main at the station and the number paid for by the consumer, for this is really the financial question to be settled. Dr. Fleming, who has devoted so much time and ability to this subject, estimates the efficiency of both forms open and closed throughout the 24 hours at 75 per cent. At Deptford they only hope for 70 per cent.—representing a truly formidable loss.

Is there any way of getting out of this difficulty about conductors? I allege there is; and again I say the remedy is in *your* hands. Instead of distributing electricity, distribute *gas* to be used in gas-engines near the spot where the electricity may be required. When, about a year and a half ago, I began to investigate the question seriously, I was surprised at the great economy of "distribution of energy by gas." Of course, it was only potential energy; and it would have been more correct to speak of the distribution of gaseous fuel.

The Editor of the *Electrician* was good enough in October, 1891, to publish a letter of mine on the subject, every statement of which has remained without contradiction. I took as an example a 6-inch gas-main, which would not cost more than about £500 or £600 a mile. Such a main would, at a pressure of 4 inches, deliver at a distance of one mile 9000 cubic feet of gas, which should yield 300 to 400 horse power. I showed that the power necessary to force the given quantity of gas at the given pressure was only one-tenth of a horse power. I thus arrived at the result that we can send as much gas as will supply 3000 to 4000 horse power one mile for 1 horse power, costing ¾d. Of course, by raising the pressure to 16 inches, the delivery would be doubled, and the power quadrupled; so that we could still send 6000 horse power one mile for 3d. This I must say is an extraordinary result, especially when you compare it with the efficiency of other modes of transfer of force so clearly explained by Mr. Kapp and Professor Unwin.

Now let us take a glance at hydraulic transmission by a 6-inch main, which, of course, for 750 lbs. pressure must be far more expensive than a gas-main which has to bear only ½ lb. or the 1200th part of that in the hydraulic main. This expensive 6-inch main will carry only 116 horse power, instead of the 600 horse power which the cheaper gas-main can convey; and while there is no appreciable loss on the gas-main, there is a loss of 20 per cent. on the hydraulic main. The cost per horse power by high-pressure water may on an average be put down at 14d. for small, to 5d. for the largest powers, against ¾d. per horse power for gas.

To revert to the question of storage, I may give Professor Unwin's figures—

The capital cost for storage of 1 horse-power-hour is estimated by him as follows:—

	£	s	d
Gas	0	5	6
Thermal storage with condensing engines	1	13	0
Do., Do., non-condensing engines	2	5	0
Epstein storage cells	8	0	0
Storage cells at Frankfort	23	0	0
Storage cells Mr. Kapp gives as £30 to £37			

Next with respect to loss in storage—

Gas	0
Storage cells—average	20 per cent.
Transformers, high tension	25 ,,
Storage battery, transformers	25 ,,
Thermal storage—not ascertained, but considering loss by radiation, say	20 ,,

Loss in transmission—

Gas	1
Electricity	10 to 30 per cent.
High pressure—hydraulic	20 ,,
Low pressure, as at Edinburgh	50 ,,

It may seem strange to some minds—especially those with municipal interests—if I make the following statement: I think it is a pity that the electric light was not hande

over to those who were already the purveyors of light to the public, I mean the gas manufacturers. In some cases this system has been recommended; but even where gas companies work independently of the corporations, I believe that they could supply the light on better terms than any separate organization. The reasons why I believe this result could be obtained are: (1) There would be no necessity for a second staff of directors, secretaries, engineers, accountants, collectors, &c. (2) In most cases there would be no need to purchase or rent any additional land. (3) A considerable portion of the existing staff of the gas-works could manage engines (and even boilers, if such were required) with but little additional cost. (4) The storage can be provided at a very low cost, and so eliminate the great difficulty arising from the great fluctuation of demand between 1 unit and 80 units. (5) If generating stations are placed at a distance from the works, the feeding gas-mains cost very little; the power employed for transmission is infinitesimally small; and the loss by leakage practically nothing. (6) The cost of production per unit is very much lower than by any other system. I believe that in most cases gas of low illuminating but good heating power can be produced on the works for 1s. 6d. per 1000 cubic feet and leave a profit; no outlay having to be incurred for mains, services, and meters—mains being charged as conductors.

As an example of what may be done with even a small plant worked with three 16-horse power nominal gas-engines, and using 70 "E.P.S." cells of the "K" type, I quote from actual working returns—

The average of the results for August and October gives the cost of—

Town gas at 3s. 3d. per 1000 cubic feet as .	1·550d. per unit.
Labour.	0·425 ,,
Oil and waste	0·014 ,,
Water	0·033 ,,
Total	2·022d. per unit.

If, however, heating gas can be made at a profit for 1s. 6d. per 1000 feet, the first item (cost of gas) would be reduced to 0·71d.; and the whole cost would be only 1·182d., or considerably under 1¼d. per unit, a cost less than is incurred in many cases where water power is employed.

I may add a few examples from Ireland. Electric lighting was started in Waterford some years ago, and the price charged for each arc lamp was £26 per annum (subsequently reduced, I believe, to £23), although the printed statements of the contractors would seem to show that the lights cost £32 each. The consequence was that the snake had bitten the infant, who died a short time since from the effects of slow poisoning; and electric lighting has ceased in Waterford, although the steam-engines were described as "beautiful compounds." In our own immediate neighbourhood, at Larne, a town of 4200 inhabitants, works were established by Messrs. Gordon and Co.—a firm which had immediately before declared a dividend of 30 per cent. A short time since, the able head of the firm, Mr. J. E. H. Gordon—a man of great and very varied attainments—lost his life by a melancholy accident. This, I suppose, disorganized the Company's business, for the plant, which was said to have cost them £8000, was offered to the Town Commissioners for £6000; but the offer was declined—one of that body stating that, at the best, six years would elapse before the concern could pay the working expenses. In Carlow, a town with a steadily declining population of only 9000 inhabitants, works have been established. The current is generated by water power four miles distant from the town; but, as far as I can learn, the income of the Company could scarcely pay the rent, the upkeep of the plant, and any fair salaries to the officials. English people can hardly understand how small is the number of inhabitants in an Irish country town who can afford to pay for any luxury, or incur any expenditure save what is strictly necessary. If the city of Waterford—an important port, where several lines of railway converge—with a population three times as large as that of Carlow, could not support a central station, I do not see how the latter can be successful. But Killarney, with a population of 5500, is boldly venturing upon a similar experiment, although the town is a "Sleepy Hollow" amidst beautiful scenery except for a few months in the summer and autumn, when artificial light is not much required.

I had intended to make some observations on the testing of illuminating power, founded on the idea that the producers should get some credit when they give more than the parliamentary standard; and, in fact, be credited with the average within certain limits. The Board of Trade has recognized this reasonable system in the case of gas-meters—allowing a variation of 5 per cent., and something similar in the case of electrical tension, although a difference of 1 volt may make a difference of 5 or 6 per cent. in the light. But I have already occupied your time too long. I cannot, however, leave the main subject of this address without expressing my obligations to Mr. Thomas Patrick Travers, Assoc.Inst.C.E., and a member of the Institution of Electrical Engineers, a young engineer of great promise, who has practically studied electricity as well as gas supply. He has pointed out to me many of the facts which I have detailed to you, and has checked my statements. I think it would be well if many of our members would imitate his example, and give attention to the new lighting agent, as I have shown it is so closely connected with our future interests.

It is now more than ten years since, at the Gas and Electrical Exhibition at the Crystal Palace, you wanted me to express my views. I pointed out that in 1810, as now, the best mode of distribution was by copper wire, and the best wick for the electric lamp was carbon. Sir Humphry Davy had established these facts. But in the generation of electricity from mechanical force, an enormous advance has been made since the time when, over 80 years ago, this "new planet" first "swam into the ken" of the great philosopher; and what is most remarkable is the fact that this marvellous growth was derived from two small laboratory experiments. First of all Oersted, in 1819, discovered that a magnetic needle suspended on a pointed pivot was deflected if an electric current was passed through a wire in its vicinity, and parallel to it; and thus electricity produced mechanical movement. It seems strange that no one thought of trying the converse—namely, whether moving the magnet mechanically would produce a current in the wire—until 1831, when Faraday made his great discovery that, in a conductor moved into or out of a magnetic field, a momentary current was produced as it crossed what he called the "lines of force." Everything that has been done since then by Siemens, Gramme, Wilde, Wheatstone, Sadd, and others, is but the natural growth of the seed that germinated in the fertile soil of Oersted's and Faraday's intelligence. And what a growth it has been! The telegraph, the electric light and traction, and the transference of power for over 100 miles, conversations carried on between two people separated by 1000 miles, electro-metallurgy, the separation of rare metals from their matrices, and the thousand offices performed by this deft and willing servant of man. When your practical man scoffs at what he calls the toys of science, let him reflect on the momentous issues of these two simple experiments. In the whole history of practical science, nothing is so amazing as the development of dynamo-electric energy. Compare it with the steam-engine. Now, nearly a century and a quarter after Watt's great discovery, engineers can convert into power only 10 per cent. of the heat evolved in the boiler furnace; and, in not much more than a decade after the invention of the dynamo, over 90 per cent. of mechanical power had been converted into electricity—a sudden bound from tentative and moderate success to practical perfection. Brilliant as is the fame that irradiates the memory of Watt and his disciples, a far brighter meed of praise is due to Faraday's successors, who in so short a time eclipsed the glories of a century. And this important deduction is to be made, that it is "beyond the wit of man to devise" any system by which a larger yield of electricity can be gathered from a given quantity of mechanical force. The Goddess sprung full-armed from the brain of the Philosopher.

And when we remember the small grain that was sown and the mighty tree under whose branches we gather and find shelter, let us venerate the memory of those who devoted their lives to science, and remember that the observation of minute phenomena may, as the weather-marks in the tree guide the Indian wanderer, lead us into new paths of progress, open out new vistas of thought, carry us into new fields of industry, and, by raising our thoughts from small effects, lead them to contemplate the great causes that surround us and govern our lives. Every new observation enables us to learn something more of these laws of Nature which,

misapprehended, lead to failure on failure, but which, if rightly understood, may minister to the physical well-being of man, and elevate his mind to those loftier planes of thought where he will stand but little below the highest intelligence. As he rises from level to level, his horizon widens, and each generation gathers a broader view of the vast expanse which Nature spreads before it with all the variety and beauty of a garden and the grandeur of a woodland, interspersed with the sheen of many a sunlit lake, and the sober shadows of alleys sheltered beneath the lush verdure of overhanging arches of the primeval forest.

REPORT OF THE COUNCIL.

At this Thirtieth Annual General Meeting of the Institute, the Council have the pleasure of presenting the following Report:—

In connection with the establishment of a Chamber of Arbitration for London, a letter was received in August last from the London Chamber of Commerce inviting this Institute to nominate gentlemen who, from their position and experience, might be considered competent to act as arbitrators in gas matters. To the invitation, your Council replied that, in the case of this Institute, the President for the year would be prepared either himself to undertake the duties of arbitrator in gas matters, or to nominate others to act in that capacity.

At the close of 1892, the position of the Institute as regards membership was as follows:—

Honorary Members	21
Ordinary Members	423
Extraordinary Members	44
Associate Members	30
Associates	51
Total	569

Last year eleven candidates were elected as Members, three as Associate Members, and four as Associates. One addition was made to the list of Honorary Members; and four transferences were made to the class of Members. Several applications for membership were unfortunately received too late to be included in the balloting papers. Members are reminded that March 31 in each year is the limit fixed by the rules for the return of proposal forms. Members are invited to continue to use their best efforts to increase the membership roll, and to further in every suitable way the usefulness of the Institute.

With deep regret the Council have to record the following losses by death:—

Henry M'L. Backler	London.
Ralph Betley	Wigan.
John Cumming Duncan	Sheffield.
J. Hodgson Jones	London.
William Mackenzie	Dunfermline.
S. R. Ogden	Blackburn.
William Upton Tinney	Winchester.
C. E. Walduck	London.

As will be seen from the balance-sheet issued with this Report, a heavy expenditure was incurred last year in connection with the volumes of Transactions for 1891 and 1892. Your Council hope in the future to reduce the expenditure under this heading.

The Council have pleasure in expressing their thanks to the several donors of the contributions which have been presented to the Institute library during the past twelve months. The additions are enumerated in the list appended to this Report. Contributions of books, pamphlets, &c., bearing upon gas matters will be heartily welcomed; and, if received in time, will be included in the list printed in the current year's volume of Transactions.

In connection with the recommendations from the Publications Committee appended to last year's report, respecting the desirability of giving in an early issue of the Transactions a General Index to the papers and communications which have appeared in the Proceedings from the commencement, the Council are glad to state that this work has kindly been undertaken by some members of the Committee; and it is hoped that the compilation will be completed in time to permit of the Index being included in the current year's volume of Transactions.

Your Council during the past session have given consideration to the desirability of providing members with certificates recording their connection with the Institute, and have decided to issue the same. The preparation of a suitable design is now in progress; and it is hoped that the certificates will be ready for issue to members desiring them at a date not very far distant.

Your Council regret to lose the services of Mr. William H. Harvey, B.A., who has for the past three years filled the office of Secretary of the Institute. His literary abilities, his attention to the duties of his position, and his untailing courtesy, have been of invaluable service to the Institute, and entitle him to the thanks of every member. The Council have, therefore, accorded a resolution of thanks to Mr. Harvey, and resolved to have the same engrossed and presented to him.

Mr. Frederick George Burfield has been appointed to succeed Mr. Harvey.

Appointments.—Mr. E. H. Millard, Manager of the Hinckley Local Board Gas-Works, has been appointed Manager of the Durham Gas Company's works. Mr. James Ross, Assistant Manager at Tain, has been appointed Manager of the works, in place of Mr. Waddell, who has gone to Blairgowrie.

Gas Lighting for Railway Trains.—It has been decided to adopt the "Coligny" gas-lamp, of the Lamp Manufacturing Company, Limited, for lighting the whole of the international cars on the Belgian States Railway, as well as the state carriage of the King and the Post-Office vans; and it is expected that these lamps will be employed for the whole of their carriages.

Death of Mr. Alderman Hinchliffe.—It is with regret that we record the death of Mr. Alderman Hinchliffe, who, for the past fourteen years, has taken a prominent part in the work of the Manchester City Council. In connection with the Gas Committee, he rendered very valuable services; and, as a member of the Water Committee, his practical experience in masonry and other important works has been of great advantage during the progress of the Thirlmere water scheme.

The "Inquiry Circular" Trouble at the Antipodes.—We learn from a letter recently received from the other side of the globe that gas managers there are afflicted, equally with their colleagues in the mother country, with the "inquiry circular" plague. In the case in point, there were about a score of questions set forth on a printed page; those relating to the manager and the men under him being specially inquisitorial. One gentleman into whose hands the circular came, and who has always shown himself willing to exchange *bonâ fide* courtesies, thought these inquiries a little too strong; and he therefore very properly declined to reply to them.

Society of Engineers.—At the meeting of this Society on Monday evening last week—the President (Mr. W. A. Valon, J.P.) in the chair—the paper read was on the subject of "Hydraulic Lifts;" the author being Mr. R. Carey. He divided hydraulic lifts into two classes—direct-acting and suspended; and he observed that the latter, on account of their greater cheapness, were becoming more common. Several water-saving lifts were referred to, and their advantages and disadvantages pointed out. The author also called attention to a low-pressure suspended lift, and alluded to a curious old patent specification, dated 1802, in which the same thing was described.

Cooking and Warming by Gas in Railway Trains.—The Midland Railway Company's announcement of the establishment of *table d'hôte* dinners on their trains—to commence, both in first and third class carriages, next month—is more of a "new departure" than it appears to be, inasmuch as the work will be done entirely by the use of compressed oil gas in cooking apparatus specially designed by Messrs. Fletcher, Russell, and Co., Limited, at their Warrington house. The gas will be carried in cylinders under the saloon; and it is intended to use the same fuel also for warming the carriages in winter. The use of oil gas, of high illuminating power, for cooking and heating purposes is at present very unusual; and for railway dining saloons the Midland Company have made the first successful attempt. The running trials were made some time ago; and we learn that the arrangements proved perfect in every respect the first time the burners were lighted, although they had been designed from theoretical calculations only.

An Old Indian Water-Works.—A description of an old Indian water-works at Aurungabad, built in the sixteenth century, is described in a recent issue of *Indian Engineering*. The supply is drawn from a filter gallery 9460 feet long, 2 to 3 feet wide, and 6 to 10 feet high, cut in a trap formation near a river. The roof is arched with bricks, and is below the bed of the river. From this gallery the water passes through a syphon of cut stone pipe, and then runs for some distance through a pipe and covered channel until it reaches a fountain in the shape of a stone bull. From this point it is distributed through unglazed earthen pipe surrounded by 6 inches of concrete. The difficulty as to air-valves is met by vertical masonry columns, which allow the water to reach its own level. In the city the water is distributed by means of several small open masonry cisterns. Here trained men are able to gauge accurately the supply for private gardens by placing a brick over the open mouths of the distributing-pipes, which begin at these tanks.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1110.)

THE past week was a much happier period on the Stock Exchange, as it well might be after the exciting times which have ruled of late. The outlook in all the hitherto disquieting quarters had distinctly improved, apprehension was allayed, and an interval of rest and breathing-time was welcome. Business was very quiet—an attitude of caution and reserve being the prevailing *rôle;* but nothing could prevent prices from going up to a slight extent. The abundance of money, too, had its influence in that direction. A reduction of the Bank rate was inevitable; and on Thursday it was put down to 3 per cent. If unforeseen external troubles do not arise, a further reduction in the near future is quite on the cards. Business in the Gas Market has been more active than it has been for many weeks past, though it was quieting down towards the close. Participating, too, in the general upward tendency, prices throughout were very good; and several substantial advances have been made in the quotations. In Gaslights, the "A" opened quiet and unchanged, but soon felt the rising tide; and, after some brisk dealing, it closed on Saturday at its best, with a mark of 222½. The secured and limited issues were also in good demand; the "J" 10 per cents. rising 2. South Metropolitans were not particularly busy; and prices for the most part were not remarkable, but the quotation of "C" rose. More was done in Commercials than has been effected for weeks past; and figures were good, but only the old stock advanced. The Suburban and Provincial undertakings were absolutely stagnant; no business being recorded in any one. Business in the Continentals was fair, especially in Imperial, which scored an advance. None of the rest made any conspicuous show, except Buenos Ayres, which was favourably affected by the Directors' report and circular indicating the immediate return of the Company to a dividend-bearing status, after a long period of depression. Both the shares and the debentures rose upon this intelligence. Business in the Water Companies was quiet and heavy; prices all round being disposed to ebb away. Southwark and Vauxhall had a heavy fall on the announcement that the dividend cannot be maintained, and will be reduced to 6 per cent.

The daily operations were: The Gas Market opened unchanged on Monday, and kept rather quiet all day; but the tendency was firm, and in favour of better prices, if business had been brisk enough. On Tuesday activity awoke again; and there was plenty of dealing in the Metropolitan stocks and Imperial Continental. Gaslight "A" rose 1½; and Commercial old, 1. Water was flat. Southwark fell 4; Kent, 2; Grand Junction, 1½; and Chelsea, East London, and Lambeth, 1 each. Gas continued active on Wednesday, and maintained its advanced position. Further advances were freely scored on Thursday. South Metropolitan "C" rose 2½; Gaslight "J," 2; ditto "A" and Imperial Continental, 1½ each; Buenos Ayres, ½; and ditto debentures, 1½. Southwark Water had a further drop of 5. Friday found the Gas Market somewhat quieter; and prices remained steady. Saturday was similar; Gas quotations closing unchanged. In Water, Lambeth and both Southwark issues receded 2.

ELECTRIC LIGHTING MEMORANDA.

Gas-Engine Sub-Stations for Distributing Electricity—Private Installations v. Public Supplies—Powerful Incandescent Lamps for Street Lighting—The Defects of Arc Lamps.

THERE was a short article in a recent number of the *Electrical Review* on the subject of gas-engine sub-stations for the distribution of electric lighting. It is remarked that there is a likelihood of such a system proving useful where the circumstances are favourable. Our contemporary's ideas as to what constitutes "favourable" circumstances in this connection are, however, somewhat mixed, inasmuch as it is stated that "the two essentials required are that coal should be abundant, and therefore cheap, and that the lighting should cover an area having compact districts, each of which could be supplied from a sub-generating station." The second condition is reasonable enough; and we are not disposed to quarrel with the remark that the patchy character of such lighting is one existing in several north-country towns. The idea that abundance of coal, or its cheapness, has anything to do with the matter is one that could only occur to a writer ignorant of the factors that make for success in gas distribution. It is cheap gas that is required for the popularity of a gas-power station, whether for electric lighting or any other purpose, and this has no necessary connection with cheapness of coal. It is true that cheap coal and cheap gas do frequently go together in the manufacturing districts; but this is only because the cheap coal induces that density of population and manufacturing activity which render gas distribution an easy problem. There are gas-works situated next door to coal mines that sell anything but cheap gas, and some of the cheapest gas in England is to be had at Plymouth—far enough from the source of the raw material. When electricians can thoroughly understand the meaning of this puzzle, they will be in a fair way to comprehend the economic conditions of their own business better than they appear to do at the present time.

Returning to the subject of the generation of electricity by means of gas-engines, our electrical contemporary states that there must be something in the plan, because a certain large building has been lighted in this way for two years; and it has been found that, with gas at 2s. 9d. per 1000 cubic feet (not particularly cheap, by the way), the cost of the gas worked out to 1·1d. per unit generated—the total cost coming to 3d. per unit including attendance, interest on capital, depreciation, and everything. A private electric installation, however, is a totally different thing from a public sub-station; and the argument to be drawn from the figures in the case quoted rather tells against a public lighting plant as compared with a private supply, than for any system of working the former. It is nothing more than a repetition of the old story, that for large buildings where the electric light would be worth having, especially if it is a theatre or a house of business where the lighting is only required for definite periods during the 24 hours, it pays far beteer to generate the electricity on the spot by means of gas-engines than to lay on the public service. This is one of the chief troubles of the central station companies; and when the large user, as sometimes happens, has a connection made with the public mains merely for the sake of a stand-by, without any intention of using it except on an emergency, it is like adding insult to injury.

It has often been proposed to use incandescent lamps for street lighting; and the experiment has been frequently tried, but never with lasting success in the case of incandescent lamps of the usual power, on account of their costliness and general inefficiency for rough outdoor lighting. Electricians may have managed to persuade some householders that an 8-candle power lamp is good enough to replace an ordinary flat-flame gas-burner for living-rooms; but the illusion has lamentably failed whenever the feeble, delicate bulbs have been hoisted up on a common, irreconcileable street lamp-post. Mr. Sydney F. Walker has, however, tried what can be done in this direction with large incandescent lamps; and he has undertaken to prove in the town of Cardiff that lamps of this description are really better for street use than the unmanageably brilliant arc lamp. In this forlorn hope it is curious to find him relying upon the same arguments, expressed in much the same words, that have been employed by the advocates of improved street gas-lanterns. He declares that the lamp of the future for street lighting will be an [incandescent electric] lamp of from 300 to 400 candle power for the majority of the busy streets of our great towns, with larger lamps of say, 600 to 800 candle power for large open spaces and important street crossings, and smaller lamps, such as 50 or 100 candle power, for the less important streets. The last estimate errs on the side of excess; but, if the term we put in brackets is read "gas," the assertion might emanate from a gas engineer—say, such an authority on the subject as Mr. Stelfox, of Belfast. Mr. Walker's views are, he says, based on the fact that what is required is not a pretty light, not a soft moonlight, but such a light as will enable the traffic to be conducted with the minimum chance of accident. "The light that will do this is not necessarily the brightest light—men cannot work with the sun right in their eyes—but the light which will enable drivers of vehicles, pedestrians, and policemen to see where they are going, and what is approaching them in every direction. The light which will do this is the one that is well diffused, leaving no dark shadows, and *that does not go out or vary much in brilliancy*." The italics are ours. Here we have a good high-power street gas lantern described to a nicety.

It takes an electrician to show up remorselessly the weak points of an electric lighting system. Mr. Walker will have none of the arc lamp, which he truly says must be used in excess of reasonable requirements if dazzling alternation of glare with gloom are to be avoided. Moreover, he argues that, while an incandescent lamp only goes out "when the limit of life is reached" (?), the arc lamp even now "is very apt to go out at uncertain intervals, leaving for the moment large spaces in total darkness, and giving considerable danger of accident in crowded thoroughfares." He is aware that this impeachment has been denied in some quarters. It has even been stated that the arc lamps do not go out in the City of London streets; yet he makes the unsympathetic rejoinder that if this is so, it is remarkable that the Corporation of London have thought it necessary to impose fines for the extinction of arc lamps, "and either the amount of the fine, or the chances of its occurrence, are so serious as to warrant the contracting company incurring the expense of equipping their line men with tricycles, so as to enable them to get quickly to any individual lamp which is reported as being out." This touch about the tricycles will go home. The curious thing is that it does not occur to Mr. Walker that a street lighting authority persuaded of the justice of his views respecting the essentials of good public lighting would be likely to pursue the inquiry further, and ask why they should pay five or even six times as much for the use of a powerful incandescent electric lamp as would be sufficient to procure the same service, even more reliably, from gas.

THE DILATORINESS OF THE STANDARDS OF LIGHT COMMITTEE.

Is it not almost time that something was heard of the doings of the Board of Trade Committee on Standards of Light for use in the photometry of London gas? The technical world has been very patiently waiting for some disclosure of the nature of the fruits to be expected from the labours of this distinguished body of experts. But the Committee have made no sign; and it is becoming a curious question as to whether anything is, after all, to come of this once promising reference. At any rate, we think it advisable to take this opportunity of reminding the world, which is in danger of forgetting the fact, that the Committee are still in corporate existence, and are presumably engaged in pondering their report. The Committee, it should be remembered, was formed in December, 1891; and the first meeting was held early in the following month, when Dr. Odling was chosen Chairman. The Secretary is Professor Vivian B. Lewes, Chief Gas Examiner for the City of London; and the whole thing is being carried on upon the faith of a promise on behalf of the South Metropolitan Gas Company to defray the necessary expenses, providing that no other means of meeting the expenditure can be found. We are unable to say what the South Metropolitan Company's Directors think of their engagement after this lapse of time; but the delay in bringing the work of the Committee to an issue is something to which public attention should be called. It is a wonderful thing that so much difficulty should be encountered, and hesitation shown, in formulating a plan for replacing by some more efficient substitute the statutory candle which was so naturally chosen long ago as the unit of light for photometrical purposes. If the parliamentary standard candle were a sentient being, it would laugh at finding itself in the same position as so many other makeshifts and compromises in the British Constitution—a mark for general abuse, but, clung to all the same for want of a substitute commanding general approval and acceptance.

Meanwhile, London gas is being tested daily by the candle; and all the "most tolerable and not to be endured" anomalies of the statutory photometrical system of London and the country at large are being exhibited in full swing. A huge manufacturing interest is being subjected to regulation with reference to an admittedly unsatisfactory standard of quality; and those who were charged with its deliverance from this condition are dumb. It is not as if the Committee had been entrusted with a totally new and strange enterprise. The impeachment of the candle and the suggestion of a better standard are tasks that had been essayed over and over again by single workers, by groups of experimenters, and by committees, long before this Committee was appointed. All that the new body had to do was to collect and compare the records of the old work, to clear up any discrepancies and doubtful points that the earlier workers might have left, and to propose something upon which the members, representing as they do various interests, could say they were agreed. Then, it was understood that the Board of Trade would take steps to carry the recommendations of the Committee into effect.

It is very disappointing that the reference should have hung fire in this way. These long investigations seldom come to any good result. In the present case, we should not be surprised to learn that the Committee, failing to come to an agreement, had been discharged, like a hopelessly puzzled jury; or to hear that, in desperation, they had settled upon some proposal that none of the members would defend save on the score of weariness of the whole subject. Seeing, however, the magnitude of the interests at stake, and the dogged character of more than one member of the Committee, it may be taken as more likely, in the event of failure to agree upon a good working standard, that the Committee will break up. We are not expecting or prophesying failure, having no knowledge of what the Committee can or can not do with the matter in hand; but we only name it as at least a possible issue of a business that has been so long a-doing.

Outsiders cannot be expected to close their eyes to the truth that the task of the Committee has been rendered immensely difficult by the absence of any guidance from without. There is no sort of agreement among men of scientific or technical training as to what is entitled to be regarded as a satisfactory standard of light. A Committee can hardly be expected to originate anything of the kind; and when such a body does so far extend its labours, the result is seldom satisfactory or conclusive. On the other hand, what can a Committee do when made cognizant of proposals which, although individually defective, might, by moulding, be made to yield a passable result? It will be remembered that this was the dilemma of the Small Arms Committee, who had to advise upon the weapon for the re-armament of the army. They had a general idea of what was wanted; and when they found that none of the models of magazine rifles submitted to them would answer, although several of them indicated what was required, they proceeded to evolve an arm which the Government subsequently adopted. In the case of the Standards of Light Committee, however, the difficulty was of quite a different kind. There was no suggestion from without of a thoroughly satisfactory standard of light; but then, on the other hand, they were not asked to find a universal standard, but only something that might serve for the photometry of London gas. Unfortunately, the limitation of the application of the required standard has not helped the Committee much; while the inherent difficulty of standardizing light has remained the controlling factor of the problem.

The work of earlier English experimenters pointed to pentane as affording a possible substitute for the candle; and pentane has accordingly bulked largely in the minds of the Committee. It could not be otherwise. At the same time, it is impossible to close one's eyes to the significance of the fact that no photometrists out of England, and very few of them here, use pentane if they can help it. The ultra-philosophical Germans make shift with the Hefner-Alteneck lamp, which English photometrists despise. The scientific Frenchmen are content with the Carcel lamp, which men of other nationalities refuse to accept as a standard worthy of an accurate worker's respect. The Dutchmen think they have done all that regard for exactitude requires when they have corrected the amyl-acetate lamp with an admixture of another kind of spirit. Both Germans and Frenchmen make use of candles; and in Germany and France there have been attempts at the construction of a non-combustion standard which have no present practical value. Meanwhile, gas managers all the world over make use of the Methven slot, and do not trouble themselves very much about its calibration.

Amid all this conflict of voices, the English friends of pentane stand alone. But, however correct their position, it must be conceded that they would find it very much more comfortable if it were not so lonely. We have been expecting the Board of Trade Committee to say something definite about a pentane standard; and we can only attribute their long hesitancy to some difficulty about the rating of a standard so framed. Lord Liverpool once posed the House of Commons by asking: "What is a pound?"—a question which raised the whole subject of British finance. It is possible that the Board of Trade Committee have become stranded over the point of defining the value of a candle when it is not a candle, but is represented by a flame of burning petroleum spirit. If so, we wish them well out of their trouble. The gas-manufacturing members of the Committee will hardly be likely to give up the candle until they are quite satisfied that they have obtained its equivalent; and small blame to them.

One cannot but regret that contemporary science should exhibit itself as so helpless in such an apparently simple matter as supplying a reliable unit of light. After what has already been published in this regard, it is impossible to doubt that, when the precise average value of a candle flame has been established, it would be possible to reproduce this value by a flame of pentane. But so it could be done, in multiple proportion at any rate, by burning colza, or sperm oil, or almost anything else that can be burnt in a lamp. It is all a question of taking precautions to secure a uniform result; and in the case of every substitute, the complexity of the precautions and the amount of care and apparatus required far transcends everything appertaining to the use of the simple candle. Nor is the question of cost a small one. The value of candles is a trifle in comparison with that of most suggested candle substitutes. Pentane may be the best, the cheapest, and the most convenient substitute for the irregular but handy candle promoted to the undeserved rank of a standard of light by our less fastidious forefathers; but, at any rate, they got their standard "out of hand," while a selection of the wisest men in England of this generation have been trying vainly for a period extending over nearly twenty years to bring in pentane or something else as a better standard.

And the worst of it is that, if the Board of Trade Committee decide, after all, upon any light of combustion as a standard, the scientific world will with one consent refuse to accept it as an ultimate solution of the problem. It is easy to understand what conditions physical science poses as necessary to be satisfied by any standard of light which shall be worthy of universal acceptance, and which a light of combustion cannot possibly fulfil. Until somebody discovers a light which is absolutely steady, white, unaffected by atmospheric conditions, portable, and perfectly under control, we must be content with what we can get; and for all that can be said against lights of combustion, they are certainly less objectionable than the fantastic standard identified with the name of Violle, or the unmanageable Siemens unit. The average man entirely fails to see that the phenomenon of melting or solidifying platinum must necessarily be more dependable in character than that of burning petroleum. If the Board of Trade Committee were in sight of a perfect standard of light, which would silence all criticism, they might be allowed to take their own time about preparing it for the public appearance that should lay the problem at rest for ever; but, seeing that the result of their deliberations will only be a temporary makeshift, intended for strictly limited application, now that most of the work of preliminary inquiry has been done for them, it must be said that they are taking an unconscionable time over their work. The only solace to be drawn from these dilatory proceedings is the reflection that, the current session of Parliament being hopelessly preoccupied with other business, it hardly matters now, from the departmental point of view, whether the Committee report this year or the beginning of next.

NOTES.

Mr. Shelford Bidwell on Clouds and Fogs.

Lecturing at the Royal Institution on the subject of "Fogs, Clouds, and Lightning," Mr. Shelford Bidwell, F.R.S., began by remarking that the popular idea is that what is seen coming from the chimney of the locomotive or the spout of the tea-kettle is steam, whereas it is cloud, steam being invisible. The lecturer proceeded to show how the expansion of air by means of a pump lowers the temperature sufficiently to cause some of the aqueous vapour in it to condense as light cloud. The influence of dust particles in air upon the deposition of cloud was exhibited; and it was shown that, as a rule, no cloud or mist will form in air which has been filtered five or six times through tightly packed cotton wool, however much the air may be saturated with aqueous vapour. Sulphurous acid in the atmosphere forms nuclei which tend powerfully to induce the deposition of water as cloud; and this, in Mr. Bidwell's opinion, is the chief cause of London fogs. The lecturer has calculated that the amount of sulphuric acid formed in the London district in one day, by oxidation of the sulphurous acid, might be not less than 200 tons. Sometimes a portion of this is blown away. If sulphurous acid is the chief cause of London fogs, the soot and tar in the air make them blacker. Smokeless stoves will not diminish the proportion of sulphurous acid poured into the atmosphere from coal-fires. The use of such stoves might make the fogs lighter in colour; but they would, perhaps, be more frequent, more dense, and more deadly. Mr. Bidwell thinks that, when the evils of the London atmosphere become too grievous to be borne, gas will probably be substituted for coal as the standard London fuel; but unfortunately it is left unsettled as to who is to take the initiative in this reform. The blackness of thunder clouds is due to the electrification of the particles of moisture, which increases the opacity of the cloud. The origin of atmospheric electricity is regarded by Mr. Bidwell as still obscure.

The Improvability of the Steam-Engine.

Professor R. H. Thurston, writing on the subject of progress in steam engineering in the *Engineering Magazine*, observes that the improvement of the steam-engine has been effected by the graduai improvement of the machine in its thermo-dynamic character, as an ideal heat engine, and the simultaneous reduction of those wastes which are characteristic of the real engine. Hitherto, all these distinct orders of improvement have been made without change in the nature of the "working fluid," or the substitution on the large scale of other substances for steam. Whether combustible gases, liquid fuels, or other substances will ever replace steam is uncertain. Some authorities expect something of the kind to happen; but Professor Thurston declares he knows no reason to suppose that superheated steam may not in the end do all that is expected of the highly-heated products of combustion of other fuels, acting as working substances. As to the wastes of the steam-engine, Professor Thurston says that the duty of a Savery pumping-engine was as 5; that of the Newcomen engine, as 12; of Watt's engine, as 27; of the Cornish engine of 1830, as 87; and of the multiple-cylinder engines of 1890, as 120—this duty being the measure of the useful work in millions of foot-pounds performed per 100 lbs. of fuel. Were there absolutely no engine wastes, the figure would become about 200, showing still a loss of 40 per cent. Stated in terms of fuel used, the gain since the days of Newcomer and Watt has been the difference between 16 lbs. and 1½ lbs. of coal per indicated horse power per hour. Still, there is room for economy of about 50 per cent. of the fuel, by dealing with the thermal wastes of the engine as a machine. "It may be probably safely estimated that the wastes of the steam power of the world, through the operation of causes more or less capable of amelioration by the ingenuity of man, would still amount to pretty nearly 300 million tons of coal every year, assuming all this immense power to be in constant operation ten hours a day." This is admittedly more than the total coal production of the world at present; but not more than will be necessary, if this waste is not checked at a very early date.

Soot Figures on Ceilings.

There has been some interesting correspondence in recent numbers of *Nature*, respecting the formation of what are called "soot figures" on ceilings. Mr. E. B. Poulton described an example which he says is the most detailed and remarkable he had ever seen. It is to be observed on the ceiling of the billiard-room in the Golf Club House, Felixstowe. Abundant soot has been deposited above the lamps by which the table is lighted; and this has mapped out on the ceiling not only the outlines of the joists, but also the position and shape of the laths and the nails by which the ends of the latter are secured. The mark corresponding to the nail-head is certainly much larger than the head itself. Dr. Oliver Lodge, commenting upon Mr. Poulton's communication, says the phenomenon is due to the same cause that produces the dust-free space seen rising from hot bodies in illuminated smoky air—namely, a peculiar Crookesian (or rather Osborne Reynoldsian) bombardment of sufficiently small dust particles in the direction of decreasing temperature, by the extra energy of the gas molecules on one side. Dr. Lodge goes on to state that dust gets bombarded out of hot air on to all colder surfaces; the details of which effect have been specially given by Mr. Aitken. The badly-conducting plaster of a ceiling is no doubt fully heated by contact with the air below, except in places where the conducting power of wood or iron keeps it comparatively cool. Hence, the picking out of the pattern. Solid deposit from warm air on to cool surfaces can occur without any actual smoke; and it can be noticed above incandescent lamps. Mr. J. Edmund Clark, writing on the same subject, suggests a distinct "if not an alternative cause" for the figures. The ceiling plaster is very porous, except where it is in contact with the joists, &c. At such points very little deposit occurs, compared with the spaces where the hot air is vigorously diffusing through into the cold space above. (This is the explanation of the figures usually adopted by gas engineers.) Mr. Clark remarks that the bombarding pattern is often very well shown where superheated water-pipes run along a whitewashed wall. The effect of every little break—even a nail in the wall—is most striking.

COMMUNICATED ARTICLE.

THE SUGGESTED FEDERATION OF GAS MANAGERS' ASSOCIATIONS.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

The favourable reception generally accorded to the propositions relating to this subject which were introduced by Mr. D. Irving, and unanimously agreed to, at the recent meeting of the South-West of England District Association of Gas Managers, warrants the supposition that the matter is not to be allowed to drop until some important endeavour has been made to obtain its fulfilment. There is a widely-spread agreement with the opinion expressed on the occasion by Mr. C. C. Carpenter, to the effect that "the existing state of things is quite wrong." Further, a belief prevails to a large extent, not merely that a remedy is desirable, but also that it is quite practicable, and that federation is the thing to be looked for. No one would be so unreasonable as to say that this result can be arrived at by a mere stroke of the pen, or to ignore the fact that difficulties of considerable magnitude stand in the way; but it would be equally unreasonable to urge this as a reason against making the attempt. And it is not too much to say that circumstances are now ripe for a decided advance beyond the unsatisfactory but frequently long-continued stage of repeating that "something ought to be done." That "good intention" failed to satisfy Mr. Irving and his supporters, as it fails to satisfy a great many more.

This feeling, now so general amongst gas engineers, of a need for something in the way of united action, as promising the existence of a really large, strong, and representative body, commensurate with the magnitude of the interests involved, and so far influential as to be capable of dealing vigorously and decisively with questions of interest or importance to the well-being of the profession, may be traced back to an early date. It has been foreshadowed in various ways, perhaps with more or less indefiniteness, during the last thirty or forty years. In the early days of the British Association of Gas Managers, it was strongly evident; and it was greatly concerned in leading to the formation of The Gas Institute in 1881. Especially in the light of recent events, it is interesting to look back and read of the hopes and aspirations of many prominent members of our industry at that time, before any cause of bitterness had sprung up. Then, as now, the symptoms were healthy ones, indicative of steady growth and advancement in our profession. The difficulties that had to be encountered at that time must be expected to arise now. Some who are heartily at one as to the desirability of the object sought, will be by no means so unanimous upon matters of detail; or they may be almost diametrically opposed as to the means to be adopted, or may wish to run their own pet and peculiar "fad" to the exclusion of everything else. Personal jealousies and personal interests were not altogether absent, twelve years ago; and it is scarcely possible, in any movement affecting a large number of persons in various circumstances and situations of life, to steer quite clear of them.

In searching back to trace the origin of this movement, it is necessary to note briefly the history of our industry from the time when Samuel Clegg was perhaps the only gas-works manager in the United Kingdom, to the present, when at least one individual who is is a qualified member of that profession is to be found in every town of any importance. It is necessary to follow the gradual development and progress of that industry since the days when Messrs. Boulton and Watt were the sole constructors of gas-works apparatus, right up to the year 1893, when we find that every foundry or engineering works of any magnitude can boast of some experience in this direction, and, if they do not make a special feature of gas-works plant, are prepared to undertake its construction. It is necessary to trace the course of labour pursued by those shrewd, energetic, and ready individuals, who, as consulting gas engineer, contractor for the supply and erection of gas-works distributing plant, lessee, and manager, all combined in one, have done so much in the way of pioneering work. Closely following them, came the resident manager or clerk of the embryo undertaking—a person having no special training or technical knowledge, often

called in from some other and very different branch of employment, who kept the accounts and superintended the daily operations under the guidance and instruction of the consulting engineer. He might have been a schoolmaster, a tradesman, accountant, rate collector, or what not. His only qualification was a fair business aptitude, and a certain amount of spare time which he was glad to fill up for a moderate remuneration. Sometimes, ability to invest capital or command local influence was the sole recommendation; and then, if more solid qualifications were absent, things went wrong, and the undertaking was hampered in many ways, before the right man, in the natural tendency of events, came to the front, and the wrong one retired to his native obscurity. In course of time, many of these gentlemen, having their abilities sharpened and put to the test by the continual increase in the demand for gas—increases which they were often most inadequately prepared to meet—blossomed out into consulting engineers on their own account. It was only natural, when any gas undertaking came into low water, that someone should suggest that, as there was a man in the next town who had done well for the gas concern there, he should be called in. These gentlemen were educated in the hard and unmethodical, but nevertheless efficient, school of every-day practice—a school in which there are more failures than in any other system of education, but in which those who do qualify carry certain capabilities, such as tact, self-reliance, and readiness of resource, that are not conferred by any other course of instruction. Each of these two classes left its special stamp on our industry; and neither of them is yet obliterated. With increased growth, the special features of individual genius, which had been so marked during the first twenty years or so, began to merge in the general advancement. A stone dropped into a small puddle agitates the whole; but a similar stone dropped into a large pond exerts only a limited local influence; and all who have visited gas-works in various parts of the country must have been struck with the vitality of certain special features or details of apparatus or ways of working originally introduced by some master-mind, which are retained as though they were indigenous to the soil. The late Mr. Henry Cockey, of Frome, for example, has left a stamp on gas-works apparatus as generally used in his part of the country, that will not die out for a century; and similar instances might be cited for other districts. Then it began to be perceived that in London and large towns the supply of gas would attain such proportions as to call for the very highest type of engineering ability; and the laying out and construction of more extensive works became an important branch of that profession. As the old orders pass away, they are replaced by younger men who have not only been specially trained, but have enjoyed the advantages of technical education, including laboratory and workshop practice, such as their fathers could not possibly obtain, in addition to the results of the accumulated experience of their predecessors.

The "personal jealousy" and "personal interest" items were in evidence from the very first. Not only were the gates of the gas-works locked and guarded, to the exclusion of the outside public, professional and otherwise, but in some cases even the chairman of the company did not dare to venture, uninvited, into the retort-house where his dividends were earned. This state of things was only possible while the undertaking was on a very small scale. Further, it represents the practice of a minority only; and therefore it was bound to give way before the more liberal and enlightened tone of the majority. Gas engineers began to see that there was some advantage in combining; not, it must at once be explained, in the more modern sense of this word, which means an endeavour to raise prices or to prevent their reduction—a thing that in most cases is simply a quixotic rush at a windmill. In these days, when we read and hear so much of trade combinations, it is necessary to emphasize the fact that the Trade Union element has never entered Gas Managers' Associations. The worst that can be laid to their charge is a mild plea, put forward in the course of a presidential address, for appropriate remuneration for the services of gas managers. The object in view, in this case, was simply the exchange of information as to the technical, financial, or commercial aspects of the gas industry. The JOURNAL OF GAS LIGHTING made its appearance, first on a field which is now fully occupied, as every trade and profession boasts at least one "organ." Special features of the first few volumes were the "Communicated Articles," which embodied a high-class advanced educational style, and the "Correspondence" columns, which teemed with valuable practical information. The advantages secured by this broadening of ideas led, as a natural development, to the desire for an Association, and for holding meetings at which technical and other interesting matters could be discussed. And so, in the course of time, the British Association of Gas Managers—starting with a small beginning, as many important movements do, for pioneers are scarce in every department—was established, and commenced a not rapid, but still a very steady growth. This was further improved upon, in course of time, by the formation, in addition, of District Associations. The gradual improvement of railway traffic rendered it possible to hold day meetings, which could be attended by nearly all the members without involving a night away from home; and the day meeting is a vital part of the District Association.

But it soon became apparent that there was room for something more—that the presidential address, the paper, and the discussion might be done to death, and yet leave a great void. Another disadvantage was the fact that the progress of events in the gas industry is not sufficiently rapid or varied to provide enough really new matter for the numerous papers, &c., that were read. It has always been an unspoken law that an Association must justify its existence, and that a programme of some sort must be forthcoming periodically as the time for each meeting comes round. Pathetic appeals from harassed secretaries and presidents become prevalent; and hurriedly-written and pointless communications come into existence. Everybody, by this time, knows the "stop-gap" paper: A wordy prologue, setting forth the distaste of the writer to prepare a paper at all, and especially on the particular subject allotted to him; a compliment to the persuasive powers of the "energetic" president or secretary; a more or less patchy and ragged historical notice; and then (following the lady's precedent of giving the most important part of her letter in the postscript) a word or two of practical experience, which forms the only valuable part of the paper. Give to all this a final touch in the form of another apology, or a dolefully expressed hope for a good discussion, and we have a specimen of a form of composition that has appeared so often as to set some people against Gas Managers' Associations, to lead them to undervalue the meetings, which they refer to in anything but polite language, and perhaps to hold aloof altogether from membership. It need scarcely be added that absence and indifference about the meeting increases the evil, and that the remedy is to be looked for in the opposite direction. Now that a move towards improvement is to be made, a grand opportunity is afforded for those who are dissatisfied with the existing order of things. Nothing but sheer laziness and indifference on their part can prevent more gentlemen who hold such views from extending their active support to the movement.

(To be continued.)

The Bromley Gas Company's River Pollution Case.—In the necessarily condensed report of the above case which appeared in the JOURNAL last week, two or three points did not come out so clearly as they might have done. The Company's Engineer and Manager (Mr. W. Woodward) received the intimation of the leakage on the 7th of January, 1892, and by the 13th he had constructed in the stream a dam into which the leakage would run; thus keeping the stream clear of it. The leaking ammoniacal liquor was daily pumped out of the dam, and measured; and it was proved not to exceed, at the very outside limit, 24 gallons in the same number of hours. At the time of the leakage, the water passing down the stream was equal to 1,000,000 gallons per day; and the velocity of the water was a foot per second. The cyanides in the liquor did not exceed 0·2 per cent. Professor Lewes, in the course of his evidence, stated that, if the leakage of liquor had been 50 instead of 24 gallons per day, and if the quantity of water passing down had been only 500,000 instead of 1,000,000 gallons, as proved, the horses would have had to drink 3100 gallons of such mixture to take in a fatal dose.

Mountain Reservoirs in Alsace.—The *Economiste Française* has lately published some interesting particulars with regard to the construction of mountain reservoirs in Alsace during the last ten or twelve years; the work, which at first met with a good deal of opposition from the peasants of the different localities, who looked upon the water they did not themselves use directly as lost, having been conducted by the State. According to a paragraph on the subject which appeared in *The Times* last week, one of the first undertakings was to regulate the two lakes in the valley of Orbey, known as the Black Lake and the White Lake, these two now holding 3,000,000 cubic metres of water, so that the cotton and other factories in the valley of Orbey are now able to work all the year round, and there is a constant irrigation of the pastures. The total cost did not exceed £3000; and the annual expenditure is only about £160. A second reservoir was constructed near Sewen, in the valley of Masseraux. This reservoir, surrounded by a wall nearly 90 feet high, contains 1,100,000 cubic metres of water. In 1890 a reservoir was built at Allenweier, in order to regulate the waters of the Fecht—a torrent which has at various times done great damage; and this reservoir, together with three small lakes, also in the valley of Munster, holds about 2,000,000 cubic metres. The latest work, commenced last year, was the transformation of the Lauch, in the valley of Guebwiller, into an artificial lake large enough to hold the rain water which comes down from the surrounding heights, and to store it until it is required. This reservoir will have an area of 28 acres, and will hold 800,000 cubic metres of water; and, as it is fed by rain water from a surface of over 1200 acres, as much as 3½ million cubic metres will be collected in the course of the year—that is, when there is an average rainfall. The cost of construction is estimated at £43,250, of which all but £6000, contributed by the town of Guebwiller and the factory-owners of the valley, is provided by the State. The reservoir will be finished next year; and, according to the statements which have appeared, it will furnish motive power for 30 factories, and irrigate 4000 acres of pasture.

TECHNICAL RECORD.

NOTES ON NAPHTHALENE.

At a recent Meeting of the Society of Gas Lighting (New York), a paper was read by Mr. A. H. STRECKER, Engineer of the Citizens' Gaslight Company, Newark, N.J.

The author began by saying that the subject of naphthalene was one which had been dealt with a great many times, and had given rise to much lamentation and complaint among gas managers; nevertheless, he would venture to take it up again. He then proceeded as follows: Our works used to be, in olden times, first-class producers of naphthalene. Not that the heats employed for the distillation of coal were particularly high; but there seemed to have been something in the general arrangement of the plant which appeared to invite the naphthalene to settle down and stop it up. After we commenced using naphtha in place of cannel coal, in the usual way, by retorting it, the trouble gradually died out; and we rarely heard of complaints of stoppages in service-pipes, or found any accumulations of naphthalene about the works. But when we abandoned this method of enriching our coal gas, and made a mixture of coal and water gas, the trouble recommenced. In short, our coal gas had been productive of naphthalene; the oil gas, produced under comparatively low heats in retorts, had furnished a solvent for it, which the water gas, made by an intermittent process, does not, but probably instead adds to the difficulty.

We were troubled a good deal during last September and October; and although we tried all ordinary ways of preventing the deposits, we were not entirely successful till the season changed. Since then I have felt renewed interest in the solution of the naphthalene question, and have looked out for anything that might help me to steer clear of the evil in the future. Of late years we have not heard so much about it in America; present methods of producing gas having, no doubt, greatly diminished its pernicious activity. But, on the other side, where coal gas is still made exclusively, and where petroleum and its products are hardly used at all for gas making, the naphthalene trouble is still extensively felt, and receives a good deal of attention.

An article which recently appeared in the *Journal für Gasbeleuchtung*, written by its Editor, Dr. Bunte, and headed "Benzol and Naphthalene in Illuminating Gas," I found highly interesting and instructive. Of course, it treats of illuminating *coal* gas only. The Doctor classes the two hydrocarbons together, because on the formation of the one seems to depend the production of the other. He claims that, by the rising heat of the distillation of coal, benzol and its homologues (toluol, &c.) are broken up, either into their original components, carbon and hydrogen, or by the formation of new compounds of greater resistance to heat, one of which is naphthalene.

The idea that naphthalene is formed anywhere else than in the retorts is entirely repudiated. The theory had been advanced by some other gas experts that naphthalene is produced subsequent to distillation—for instance, through abrupt cooling in the condensers, or by similar influences during the passage of the gas through the works and mains. However, at the present day this idea seems to have been entirely abandoned for the more reasonable theory that all the naphthalene is generated during distillation, that most of it is absorbed by the tar of which it forms a prominent constituent, and that only a very small portion escapes with the gas.

According to Dr. Bunte, 100 lbs. of good gas coal produce (when yielding per pound 4·95 cubic feet of gas of ·440 density) 17·04 lbs. of gas, containing 1·261 lbs. = 8827 grs. of gases of the benzol series (about 75 per cent. of benzol and 25 per cent. of toluol), and also traces of naphthalene; 5 lbs. of tar, containing 0·09 lb. = 630 grs. of benzol, &c., and nearly 100 per cent. of naphthalene; and 11 lbs. of ammoniacal liquor. In another table he gives the following figures: In the gas: Benzol, 95 per cent.; toluol, 89 per cent.; naphthalene, trace. In the tar: Benzol, 5 per cent.; toluol, 11 per cent.; naphthalene, nearly 100 per cent. It would require about 45,000 grains of benzol vapour to saturate the 495 cubic feet of gas at 10° C. (50° Fahr.), or about five times as much as they actually contain. And, owing to this fact, although the boiling-point of benzol lies at 176° Fahr., and that of toluol even higher (at 232° Fahr.), the gas may be cooled down a great deal, even below the freezing point, without dropping any appreciable amount of these vapours. On the other hand, the gas contains so little of the naphthalene vapours, that this constituent is hardly ever mentioned among the rest. Left to itself, it is really a solid body, melts at 176° Fahr., and boils at 422° Fahr. When cooled down to 60° Fahr., the gas cannot carry more than 0·5 grain of it per cubic foot. This does not seem much, and yet, with a daily production of a million cubic feet of gas, it would amount to 71 lbs. of naphthalene, which, when precipitated in the apparatus or mains under favouring circumstances, can create a great deal of trouble.

It would seem that, under ordinary circumstances and temperatures, naphthalene could not go forward in the gas at all; and it is often astonishing to notice how it manages to live through the cooling of the gas to a comparatively low degree, and is afterwards precipitated under a temperature not lower, and perhaps not even so low. Probably this phenomenon is due to the fact that the naphthalene is being carried forward by some other constituent of the gas which has a lower boiling-point, and therefore shows more resistance to cold. Benzol ammonia, and aqueous vapour are mentioned as such carriers of naphthalene. The first seems the most likely one, although it is not easy to see why the benzol should drop the naphthalene when it is itself not affected by ordinary low temperatures.

Some people have held that vapours of ammonia act as carriers, and that only those gases which have been entirely or nearly entirely freed from the former will show deposits of the latter. Others have, in rebuttal, quoted cases where there was plenty of ammonia in the gas, and yet deposits of naphthalene were of frequent occurrence. It may be that the vapour of water, always present in the gas, helps to carry the naphthalene along. This was many years ago suggested by M. Lucien Brémond, who claimed that an absolutely dry gas could not carry forward naphthalene.* That this is not strictly correct was soon afterwards proved by actual tests. But it has been frequently observed that a heavy condensation of water in the mains is accompanied by deposits of naphthalene; and the comparatively cold water of condensation, not being a solvent for the naphthalene, is left where it is deposited, and is not carried to the nearest drip. From my own experience, I should judge that the drier the gas at the outlet of the works, the less trouble with naphthalene in the district is experienced. For these reasons, a member of the German Gas Association, at one of their recent meetings, proposed to erect special cooling apparatus at the outlet of the works. With true German thrift, however, he expressed at the same time the apprehension that, by reason of such cooling, the consumer might get the best of him by receiving cooler or denser gas for the same money.

A very good way of preventing gas from taking up more water after having been properly cooled in the condensers, is the covering of all exposed surfaces of water, as in the station meters or gasholder tanks, with a layer of oil. This oil, during the naphthalene season—say, from August till November—will have to be renewed from time to time, according to its being more or less volatile. We used naphtha last fall for this purpose, and syphoned it into the tanks, at the rate of 25 gallons per tank, twice a week. But the best preventive of the naphthalene difficulty is to be found in proper cooling and condensation. The production of the substance in the retorts, we cannot prevent. High heats often receive the entire blame, when works using moderate heats are frequently troubled as much as others using regenerative furnaces and high heats. The reason for this most likely lies in a difference between the two condensing plants. That of the latter may be in advance of the former—being of more modern and ample construction; and while more naphthalene is actually produced by the latter, it is kept in the tar and out of the gas.

Coal tar itself is a ready solvent for naphthalene, and all the hot scrubbers are based on the idea of removing as much tar as possible by friction, and at the same time keeping it in intimate contact with the gas, so that it may act upon and absorb the naphthalene. This action, however, is not confined to the same, but unfortunately also affects the members of the benzol series. Long-continued washing and scrubbing with tar may, therefore, pretty effectively remove both benzol and naphthalene from the gas; thus robbing the latter of a valuable proportion of its illuminants. Yet some people have actually recommended such scrubbing—arguing that what was lost by the gas getting poorer would be recovered by the tar becoming richer in benzol. It need hardly be said that the prices usually obtained for tar in this part of America certainly offer no inducement to take steps in this direction.

The proper way to proceed with the condensation would seem to, first, remove all, or nearly all, the tar as soon as possible by some effective and compact friction apparatus—a Pelouze and Audouin machine, for instance. Then, when the gas is pretty well freed from tarry vapours, subject it to a most thorough cooling in a condenser of ample proportions. Let the work be done slowly, but effectively. In a multitubular water condenser, arrange the flow of gas and water so that there is nowhere a great difference between the temperatures of the two. The less this difference and the slower the flow, the better the apparatus. Manufacturers of such condensers generally hold that from 3 to 3½ square feet of condensing surface per 1000 cubic feet of daily make is sufficient; but to do the work well, especially in these days of regenerative furnaces, when the gas comes from the retorts at a higher temperature than of old, 5 or 6 square feet of surface is not too much. In this climate, if on an average the temperature can be kept down to 60° Fahr., we shall be doing quite well. If we are able, by the use of deep-well water, to reduce this temperature still further, we shall be doing still better. Provided that the cooling is done properly—gradually, and not suddenly—no harm will be done to the luminosity of the gas, as mentioned above.

The appearance of naphtha scales or crystals on the under side of the purifier covers, when lifted after a change, is always a sure indication that the condensation has not been thorough, and is a sort of "first notice" to look out for trouble. If the condensation is properly arranged and well attended to on the lines above indicated, and if, at the critical period of the year, when the days are warm and the nights cool, the surfaces of the

*See JOURNAL, Vol. XXX., p. 491.

various sheets of water over which the gas passes are protected as shown, little trouble with naphthalene should be experienced. It is where the condensing apparatus is badly arranged, out of order, or outgrown by the increasing production of gas, that the evil becomes serious.

As to water gas, we do not hear of so many complaints about naphthalene from works producing it as from coal-gas works. Either they do not make so much of it, or the gas is so constituted as to hold it better in suspension or solution. I have not now any data showing the average percentage of benzol in the various kinds of water gas manufactured; but undoubtedly it is much higher than in coal gas. Water gas is more nearly, and in some cases probably entirely, saturated with benzol vapours. A reduction of temperature will then not only cause a deposit of naphthalene (if such be present), but also a liquefying of some of the benzol vapours, which liquid will then carry the naphthalene dissolved to the drips. It stands to reason that any water-gas apparatus is able to produce naphthalene by exposing the gas during the fixing period to an excess of heat. In the intermittent processes, the very nature of the way of working must often produce such conditions; and even in the retort processes, there must be times when, owing to the variations of consumption, too much or too hot a fixing surface is exposed to the passing gas. Then the percentage of benzol is reduced, and more or less vapour of naphthalene created, which may, if not removed by condensation, lead to the same trouble as in coal gas. Great care is required here also, both in the fixing and the subsequent condensation of the gas. As to water-gas condensation, the same general rules given for the coal gas will also answer for this case.

Additional Storeage at the Manchester Corporation Gas-Works.—Our readers will see, by the report which appears in another column, that the Manchester Corporation have now confirmed the Gas Committee's selection of the tender submitted by Mr. J. Nuttall for the construction of a gasholder tank at the Bradford Road station, which, it may be remembered, they declined to do at their monthly meeting in May (see *ante*, p. 837). The tank will be 254 feet in diameter and 50 ft. 6 in. deep. The holder it will contain (which was advertised in last Tuesday's JOURNAL) will be 250 feet in diameter, in three lifts, each 50 feet deep. It will therefore be the largest in the provinces. It is intended to provide additional storeage for the Rochdale Road and Bradford Road stations; and gas will be pumped into it from the former works. The erection of the holder will bring up the total storeage capacity of the undertaking to 25 million cubic feet. Both the holder and the tank have been designed by Mr. G. Ernest Stevenson, M.Inst.C.E., the Engineer of the Rochdale Road station; and they will be constructed under his direction.

Presentation to Mr. G. F. Brown.—Last Thursday evening, the workmen and staff at the Saltley Gas-Works of the Birmingham Corporation met together to present Mr. G. F. Brown with a clock and pair of bronzes, as a token of their esteem and respect on his leaving to take the position of Manager at the Grangetown Gas-Works, Cardiff, under Mr. Henry Morley, to which, as already mentioned in the JOURNAL, he has recently been appointed. The presentation was made on behalf of the subscribers by Mr. Henry Hack, the Engineer of the station, who alluded to Mr. Brown's long and valuable services as chief foreman at Saltley, and expressed the hope that he might be spared for many years to enjoy the promotion he had so well earned. Mr. Brown, in response, briefly thanked the subscribers for their handsome present, and said that, while admitting that the duties of his post had at times been very onerous, he felt fully rewarded for the efforts he had made by the hearty reception the employees had given him, and the handsome tokens of their esteem and repect; and he assured them that he should always look back with pleasure to the time he had spent among them at Saltley. Mrs. Brown was also presented with a morocco leather satchel.

The German Association of Gas and Water Engineers.—The 33rd annual meeting of this Association will take place at Dresden on the 19th inst. and four following days, under the presidency of Herr C. Kohn, of the Frankfort Gas-Works. Papers will be read, and the general business of the meeting transacted, in the Concert Hall of the Zoological Gardens, where also a concert will be given on the first evening. The greater part of three days will be devoted to the reading and discussion of papers; but time will be found for visits to the local gas and water works. Social functions will occupy the evenings—the dinner being on the Thursday; while the last day will be entirely given up to an excursion into the Saxon Switzerland. Visitors will be welcomed; and special provision has been made for the amusement of lady participants while the more serious work of the Association engages the members. The arrangements made reflect great credit on the Committee, and on Dr. H. Bunte, the General Secretary. The following are among the most interesting of the dozen papers down for reading: "The Manufacture of Illuminating Gas in America," by Dr. W. Hempel; "Apparatus for the Separation of Tar from Crude Gas," by Herr W. Leybold; and "The Incandescent Gas-Light," by Herr Krüger. Valuable suggestions may also be expected from the reports of the Committees on Photometry, Gas-Meters, and Heating by Gas.

REGISTER OF PATENTS.

Gas-Engines.—Hornsby, J. W., Edwards, R., and Gibbon, W. E., of Grantham. No. 11,962; June 27, 1892.

This invention relates to engines operated by the explosion or burning of mixtures of combustible vapour or gas and air. It comprises—(1) Means for maintaining the vaporizer or combustion chamber at a uniform heat; and (2) improved means for obtaining an explosive mixture when starting the engine.

Fig. 1.

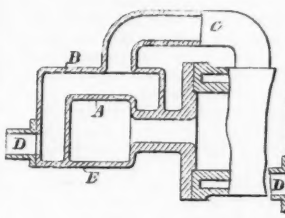


Fig. 2.

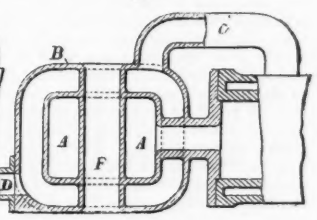


Fig. 3.

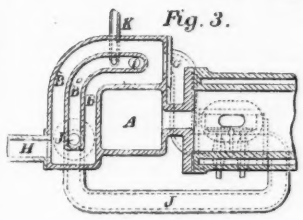


Fig. 4.

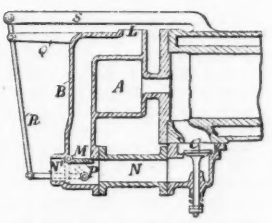


Fig. 1 shows a vaporizer or chamber A, with a partial jacket B; the exhaust from the cylinder passing by the pipe C into the jacket, and out at D to the atmosphere. Heat can be externally applied to the bottom E of the vaporizer, as required.

Fig. 2 shows the vaporizer A completely surrounded by a jacket B; the exhaust from the cylinder passing from the pipe C into the jacket B, and out at D to the atmosphere. A pipe F is used for heating the vaporizer or chamber by external means.

As shown in fig. 3, the chamber A is provided with a double jacket—viz., one jacket B for the exhaust gases to pass through, and another for air or air and gas to be drawn through. G is the inlet for the exhaust gases; and H, the outlet. I is the inlet for air; and J, the pipe leading to the air-inlet valve on the cylinder. K is the oil or oil-vapour inlet. The exhaust gases exhaust through the jacket B to the atmosphere, and, when this jacket extends outside the other jacket (as shown), also through this part of the jacket B.

Provision is sometimes made whereby the air drawn in by the engine-piston or the air-pump (as is usual in such engines) can either be drawn through the jacket B or through a passage direct from the atmosphere; and, in order to regulate the quantity of air drawn through one or the other, a damper or valve is employed, which causes the amount of air drawn in around the vaporizer to be increased or decreased by opening or closing it, and at the same time the air that is drawn direct from the atmosphere is decreased or increased in a proportionate manner.

The opening and closing of this damper is effected by connecting it to a rod or a column of mercury in contact with the vaporizer; so that, as the vaporizer becomes hot, the expansion of itself, or of the column of mercury, causing an increase in length, will regulate the valve by being connected to the same, or it can be regulated by hand.

Fig. 4 shows one plan by which this can be arranged. The jacket B which surrounds the vaporizer is open at the top L and bottom M; and a pipe N leads to the air-suction valves of the engine. P is the valve which, as shown, closes the opening at the bottom of the jacket, but which can close the opening of the pipe N, as indicated by dotted lines. This valve is actuated by the expansion of the arm Q and the vaporizer, which expansion causes the valve to be opened when the arm and the vaporizer get hot, as the lever R, which is connected to the valve, is held at its upper end by the arm S. With this arrangement, when the vaporizer becomes too hot, the valve P opens to admit cool air through the jacket, and thus cool the vaporizer; and, when sufficiently cool, the contraction causes the closing of the valve.

Gas-Engines.—Boult, A. J.; communicated from J. A. Charter, of Sterling (Ill.), U.S.A. No. 12,183; June 30, 1892.

This invention may be applied to a typical gas-engine, in which there is the usual cylinder mounted upon a base, and provided with a piston connected to the crank of the driving-wheel, which is also mounted on the base. The valve-controlling devices are attached to the end of the cylinder; being enclosed in a suitable case, which also forms the explosion chamber for the engine. The valve-chamber is separated from the explosion chamber by an automatic valve; and in the valve-chamber there is arranged a rotary three-way valve, which in one position admits gas or air or hydrocarbon and air into the explosion cylinder. The valve-case is provided with an air-admission port and opening to the air, and arranged in the valve-cases is a pipe or nozzle for the admission of the gas or hydrocarbon. Attached to this nozzle is a chamber, connected to the reservoir and a pump, and having suitable check-valves interposed in the pipe between the chamber and reservoir. The chamber is provided with an elevated portion, which forms an overflow to the chamber, and is connected by a pipe to the reservoir. The flow of the hydrocarbon from the chamber to the nozzle in the valve-chamber is controlled by a stopcock. In order to operate these valves and their connections at proper times, means are provided which are

connected to the shaft of the engine to control them; and there may be used a large gear-wheel, meshing with a pinion on the shaft—the relative proportions of the pinion and gear-wheel being as two to one, so that the gear-wheel will make one complete rotation at two complete rotations of the shaft and gear-wheel carried thereby. Mounted on the gear-wheel is a cam; and pivoted on the frame of the engine is a lever carrying on its end an anti-friction roller, arranged to engage the cam. The lever is provided with a spring, which normally holds the anti-friction roller against the cam; and it is connected by a rod to an arm of the three-way valve. Loosely mounted on the driving-shaft of the machine is a collar or sleeve, provided with a groove which engages the anti-friction roller, and moves it laterally on its bearing. Also mounted on the driving-shaft is a disc, which is fast thereon, and which carries governor-balls that are in turn connected by an arm to the collar or sleeve. By means of them, the collar is slipped laterally on the shaft, in accordance with the position of the governor-balls; and this in turn moves the anti-friction roller into and out of the path of the cam. When the engine is running at normal speed, the anti-friction roller is in the line of the cam; and the lever carrying the roller is operated at each rotation of the gear-wheel on the induction stroke of the piston. When, however, the speed is increased, the governor-balls move apart, and draw the sleeve outward—carrying the anti-friction roller out of the line of the cam. It slides on the stud at the end of its lever; and the lever will thus not be operated by the cam. But the spring will operate the three-way valve through the medium of a rod, to move it into its closed position. Arranged on the inside of the gear-wheel is a cam or projection, which engages a rod leading to the exhaust-valve in the exhaust-pipe.

The engine, thus constructed, belongs to the "alternate-explosion" or "four-cycle" type of engine. Assuming the parts to be adjusted for drawing in a charge of inflammable or explosive mixture—the anti-friction roller being on the cam which by its connections opens the three-way valve, so as to leave an open channel for air to be drawn into the cylinder through the proper air-port, which extends around the nozzle—the reduced pressure or suction which draws in the air will also draw a proper quantity of explosive mixture through the nozzle, and carry it into the explosion-chamber of the engine; the automatic valve rising to admit them. When, however, the piston makes its back-stroke, the automatic valve closes; and the charge is compressed within the cylinder, and ignited by means of an incandescent tube or other suitable means, and the piston is driven outward in the usual way. When the piston reaches its farthest out-stroke, the appropriate cam comes in contact with its rod, opens the exhaust-valve, and allows the products of combustion to be expelled through the exhaust-pipe during the in-stroke of the piston; and as this is done, the spring on the rod immediately closes the exhaust-port. When, however, the speed of the engine exceeds its normal, the governor-balls move apart, carrying the sleeve outward; and this shifts the roller out of the path of the cam, and the spring draws the lever forward, and turns the three-way valve, so as to close the passage to the air-port and the nozzle and open communication directly with the air through another port. As long as the engine is running above its normal speed, this port will remain open, and the air alone will be drawn into the cylinder, and expelled through the exhaust-port; and no explosion will occur. When, however, the speed attains its normal, and an explosive charge is required, the roller will be again moved into the path of the cam, which will open the valve. On the further operation of the engine, the charge of air and gas will be drawn into the explosion chamber as before; and the engine will continue to run in this way until it again exceeds its normal speed.

Gas Motor Engines.—Abel, C. D.; communicated from the Gas Motoren Fabrik Deutz, of Koeln-Deutz, Germany. No. 13,204; July 19, 1892.

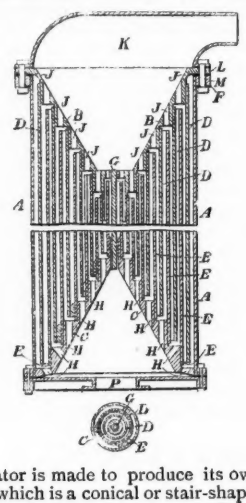
This invention relates to gas and oil motor engines working with a two-stroke cycle, whereby only a certain portion of the out-stroke of the piston is made to constitute the working stroke, during which the combustion gases resulting from the previously-fired combustible charge are expanded, after which, during a further portion of the out-stroke, the combustion gases under pressure are caused to escape, so as to leave only gases at or about atmospheric pressure in the cylinder; while, during the last portion of the out-stroke, according to one arrangement, the combustible charge is drawn in, which charge, together with the residue of combustion gases, is then compressed by the following in-stroke, in order to be fired when the piston arrives at the "dead centre." Or, according to another modification, only atmospheric air is drawn in during the last part of the out-stroke; and the combustible gas, vapour, or spray is introduced under pressure during the compressing in-stroke.

For carrying out the first method of working, the arrangement of the engine is as follows: The cylinder has at its inner end a discharge valve for the combustion gases, and a valve for admitting the explosive mixture of gas or combustible vapour or spray and air; and it is also provided with any suitable igniting arrangement. The discharge and gas valves are operated by cams on a way-shaft, driven from the crank-shaft at the same speed; the valves being operated by their cams in such a manner that, when the piston has been propelled through a portion of its out-stroke, the discharge-valve is opened for a short period, so as to allow of the escape of the combustion gases under pressure. After this it is made to close, and the gas-valve is opened, so as to cause a combustible mixture of gas or vapour or spray and air to be drawn in during the remainder of the out-stroke. The piston then performs its in-stroke, thereby compressing the charge; and, when it has arrived at the dead centre, the charge is fired. The regulation of the engine can be effected in the usual manner—by entirely cutting off, or by reducing, the supply of combustible gas when the engine is running too fast. For reducing the gas supply, the cam actuating the gas-valve is formed with a sloping face, and is mounted upon a sleeve sliding on the way-shaft, and actuated by a governor, so as to cause the cam to operate with a longer or shorter dwell upon the gas-valve, according as the speed of the engine is below or above the normal. The regulation of the power can also be effected by arranging the cam that actuates the discharge-valve in connection with the governor, so as to cause it to be held open for a longer or a shorter time, and thus correspondingly increase or reduce the time during which the combustible mixture for the explosive charge is drawn in. The passage through which the combustion gases escape from the discharge-valve is, by preference, provided with a check-valve, in order to prevent the combustion gases from being drawn back into the cylinder in the event of a partial vacuum being formed in the cylinder before the discharge-valve is closed.

According to the second method of working, the cylinder is provided, in addition to the above-mentioned discharge-valve, with an inlet-valve for atmospheric air, while the inlet-valve and port for combustible gas, vapour, or spray is connected to any suitable apparatus for supplying it under pressure—the valve being so controlled by a cam as only to admit the gas, &c., under pressure during the compressing in-stroke of the piston. Thus, during the first part of the out-stroke, the piston will (as before) be propelled by the expanding gases, until the discharge-valve is opened, so as to allow these gases to escape; and, on the closing of this valve, the further motion of the piston will cause air to be drawn into the cylinder through the inlet-valve until the end of the stroke. During the first part of the return stroke, the discharge-valve is again opened, so as to allow a portion of the charge of combustion gases and air to be discharged, after which the remainder of the charge is compressed, while at the same time the gas or oil-supply valve is opened, so as to cause the vapour or spray to be forced under pressure into the cylinder to form the explosive charge, which is ignited when the piston arrives at the dead centre.

Generation of Gas by Electrolysis.—Bedford, W. G., of Philadelphia, U.S.A. No. 4225; Feb. 25, 1893.

This invention consists of a method of generating gas, involving the subjection of steam, water, and the like to the action of electrodes, in the apparatus represented in vertical and part horizontal section.



Where the generator is made to produce its own electricity, A is a shell, at one end of which is a conical or stair-shaped cap or support B, and at the other end a similar cap or support C. Extending from the cap B are plates D of + metal; and from the cap C are plates E of − metal. The ends of the plates D are separated from the cap C, and those of the plates E, from the cap B; and care is taken in all cases that they do not touch each other. Communication only is effected by means of the fluids supplied. The rim of the cap B is bolted to a band or ring F, which is attached to the shell A; and a bolt G is passed through the caps, and attached to the cap B, so as to freely enter the cap C without contact with it. The cap is provided with openings H, to admit fluid to the plates; and the cap B has openings J, to permit the discharge of the generated gas into the dome K. The gas, as generated, is directed from the dome K to a place of service; or it may be carburetted or subjected to further treatment either before or after its passage through the generator. Connected with the cap B is a wire L; and with the band F is a wire M. These wires are connected respectively with the positive and negative poles of a battery or other generator of electricity, when it is brought from without, whereby the plates D and E become electrodes—it being noticed that the proper parts are insulated, for evident purposes.

The operation of the generator accords with the several materials supplied—that is to say: (1) Ordinary water only may be used, together with a large supply of electricity produced within or without the generator. (2) Water and any electrolyte—such as sulphuric or other acid, salt, bichromate of potassium, potassium iodide, or anything containing sodium, magnesium, potassium, or zinc—either singly or in any suitable combination, together with the electricity produced as above. (3) Either of the above may be much accelerated by using them with hot water. (4) Steam in any condition, superheated, exhaust, or ordinary steam, or as vapour, together with a large supply of electricity. (5) Steam in any condition as above named, accompanied by the vapour of any electrolyte as above described, together with electricity produced as above stated.

The operation is as follows: Steam, water, or the like is admitted into the shell through the inlet P, and directed to the plates D and E, which, being electrodes and surrounded by an electrolyte, converts the steam into gas or its elements (oxygen and hydrogen) by passing from one electrode through the fluid to the other electrode—the oxygen, chlorine, and acids going to the + electrode, and the hydrogen, metals, and the like to the − electrode; and, being subject to the pressure of the incoming material, the gas is forced to the dome K.

The Purchase of the Mexbro' Water-Works by the Local Board.—A Sheffield contemporary announces that the Mexbro' Local Board have now decided to acquire the local water-works at the price of £10,250.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by our correspondents.]

Federation v. Re-organization.

SIR,—It will scarcely be disputed that federation must be preceded by re-organization, for, unfortunately, as stated by a "Member of the North of England Gas Managers' Association," in the current number of the JOURNAL, there already exist two central bodies with headquarters in London; and until these are merged into one, there would seem but faint hope for the realization of the federationists' ideal.

Now these two existing organizations differ in but one respect. In both there are experienced and capable men who in the past have done enduring work for the gas profession, and by whom it stands enriched to-day; in both there are those younger men who are coming on, and who will have to hand down their elders' traditions of patient industry and indomitable energy; in both there are engineers of large undertakings and managers of small, actuated by a common bond of union for the general weal. Yet, in one vital point does the newer Institution differ from the old, in that an interested class, which has been somewhat contemptuously labelled "traders," are excluded from the honour of attachment either as members or associates or in any other way. At first sight this seems too severe a rule to be practised, for the peripatetic vendor of (gypsum) paint or Yankee fittings is of a very different type to the builder of gasholders, the designer of stoking-machines, or the perfector of governors—men to whom few gas engineers would be loth to acknowledge their indebtedness for friendships which, in others besides the writer's case, have been of mutual advantage and enjoyment.

But, though even these men are precluded from joining the Institution, there is nothing to prevent their introduction as the personal guests of the members to all or any of the meetings, to take part in discussions at the invitation of the Chair, and to contribute papers on such subjects as they may be qualified to speak upon by reason of their position. Beyond this it were surely unreasonable to desire to go. And, viewed in this light, does it not seem, therefore, that a happy despatch of this too prolonged vexation of disunion can be best attained by cutting, rather than wasting more valuable years in attempting the unravelling of, the Gordian Knot which holds asunder men whose heads and hearts are of one accord? Let the new Institution throw open its doors to all engineers and managers in The Gas Institute; this to be dissolved by the mutual consent of its members—arrangements being made by which the best men in each now separate body may be nominated to form the Combined Council of an Institution which shall form a fitting successor to the British Association of Gas Managers.

But it may be objected that, though such a consummation would redound to the advantage of all gas engineers, yet, as traders form a large proportion of the older Institute, their claims would prove a stumbling-block to such a settlement as is suggested. The writer cannot think this would be the case, for, as previously indicated, the real traders (among whom he numbers many personal friends) could still be present at the meetings on a member's introduction; and as for the traveller element, they need not fear as a result that an order for a brick the less, or a pound of waste or a pint of paint, will find its way to their exchequer.

In the last five years, the conditions of gas supply have greatly changed. The competition of electrical energy is no longer afar off, but at our gates; and there is urgent need for all the resources of an undivided front of watchfulness and ability, energy and experience, so that from our gas-works may be supplied the light not only of the present, but of the future too. *L'union fait la force.*

A MEMBER OF THE SOUTHERN DISTRICT ASSOCIATION OF GAS MANAGERS.

June 12, 1893.

Oxygen in London Gas.

SIR,—In the article, forming one of the excellent Articles for Gas Students, which appeared last week, an analysis is given of London gas which, in one particular, requires a little explanation. I refer to the oxygen percentage, which, as it stands (0·5 per cent.), is likely to convey an erroneous impression. In an analysis of South Metropolitan gas, Professor Lewes gives 0·15 per cent. as the amount of oxygen contained therein; and I venture to think that some accidental circumstances must have been the cause of the high percentage given in the first example. I have only been able to find still lower quantities in the purified gas; and it is somewhat difficult to understand how so large a quantity could run the gauntlet of the sulphides of lime and iron in the purifiers. The disturbing influence of an abnormal quantity of oxygen in the crude gas on the sulphide system of purification has been long known; and probably the interposition of oxide of iron vessels between the carbonate and sulphide ones increased the latter's life by acting as an oxygen catch. I should like to ask whether any of your readers use, or have used, the rotation lime system after oxide vessels, and with what result.

May I take this opportunity of supplementing a remark made at the recent meeting of the Institution of Gas Engineers, based upon the careful estimation of oxygen percentage made as part of the daily routine of experimental work carried on by Mr. Henry Hack, of Saltley? The percentage of oxygen I gave as found by him should have been stated as the maximum; the average being considerably less than half. Such daily tests of oxygen are of great value, and probably afford an explanation of the difficulty which has, though but rarely, presented itself in the rotation system, through the carbonic acid getting ahead of the sulphuretted hydrogen.

C. C. CARPENTER.

Vauxhall, June 12, 1893.

The Valuation of Coal Stocks.

SIR,—Referring to your Scotch correspondent's comment on the decision of the Edinburgh and Leith Gas Commissioners, with regard to the valuation of their coal stocks, the obligation to pay income-tax on the so-called inflated income does not appear to be a valid reason for the depreciation, because the matter would right itself in the accounts of the following year. The valuation of the coals at cost price would, of course, bring out a higher profit for the year just closed. As, however, the same valuation would be carried to the debit of next year's accounts, the effect would be that the profits would be correspondingly less; so that there is practically no difference. But, as a matter of policy, some definite course is desirable. With due regard to the nature of the Commissioners' business, it appears to me that the stock on hand at the date of balancing should be considered as *bought for the following year*; and, in this light, its value should not be allowed to operate either for or against the current year's working—that is to say, the actual price paid should appear in the balance-sheet, and the loss in market value, if any, will then arise in the year in which the coals are consumed. Such a system would place the accounts of each year in the best position for comparison, and would, no doubt, commend itself to all interested.

EDINA.

June 8, 1893.

"Hawkite" Gas.*

SIR,—This gas is really hydrogen, produced by the action of dilute sulphuric acid on metallic blocks, composed of waste wrought-iron and steel scrap. The chemical theory of the process is as follows:—

$$\begin{array}{rcl} Fe + H_2SO_4 & = & FeSO_4 + H_2 \\ 56 + (2 + 32 + 64) & = & (56 + 32 + 64) + 2 \\ 56 + 98 & = & 152 + 2 \\ 1 + 1{\cdot}75 & = & 2{\cdot}714 + 0{\cdot}0357 \end{array}$$

That is to say, 1 ton of iron, acted on by $1\frac{3}{4}$ tons of sulphuric acid, yields 2·714 tons of ferrous sulphate (sulphate of iron, or copperas), and 0·0357 ton, or 79·968 lbs., of hydrogen gas. Let x = the number of cubic feet occupied by this weight of hydrogen at the ordinary temperature and pressure; and since hydrogen is 1-14·47 of the weight of an equal volume of air, which is again 1-772 of the weight of an equal volume of water, the specific gravity of hydrogen will be $\frac{1}{14{\cdot}47} \times \frac{1}{772} = 0{\cdot}0000895$; and since a cubic foot of distilled water weighs about 62·5 lbs., we have

$$x \times 0{\cdot}0000895 \times 62{\cdot}5 = 79{\cdot}968$$

$$\text{whence } x = \frac{79{\cdot}968}{0{\cdot}0000895 \times 62{\cdot}5} = 14{,}296 \text{ cubic feet nearly.}$$

Now, if the gas is collected over water, about 1-50th of its volume is taken up by the water; therefore the available theoretical quantity under these circumstances would be $\frac{49}{50} \times 14{,}296 = 14{,}010$ cubic feet of hydrogen available per ton of iron consumed. If the resultant saturated solution of ferrous sulphate and water, and the small quantity of unworked-out acid, be allowed to stand some time in a suitable vessel, the ferrous sulphate will take up the necessary water, and become crystallized sulphate of iron $FeSO_4, 7OH_2$, the atomic weight of which is $[56 + 32 + 64 + 7(16 + 2)] = (152 + 7 \times 18) = 258$. Now, dividing this by the atomic weight of iron, we have $\frac{258}{56} = 4{\cdot}964$ times the weight of iron consumed as the theoretical weight of the crystallized sulphate of iron produced.

As a commercial undertaking, this would appear at first sight to be a good speculation, especially to anyone unacquainted with the process; but on entering into the matter, and on working out the various cost items, it will be found to be very deceptive. Taking first the price of the iron blocks, it will not be safe to assume less than £6 per ton as the selling price, as the writer has found from practical experiment that, in order to obtain anything like good results, selected scrap wrought iron or mild steel is necessary. If cast iron or high steel is used, it is found that the contained carbon, which does not take any part in the process, but is simply deposited as so much dirt, makes a great deal of mess in the generator. It is also necessary that this selected wrought iron or mild steel should be free from dirt and dust of any kind, to insure good results. Now as to the price of the sulphuric acid, which, for the best evolution of the gas, should be the best concentrated, of 1·84 sp. gr., the lowest reliable price in the market for this is £3 15s. per ton, although the "Hawkite" Company base their calculations on £3 5s. per ton. The sulphate of iron crystals fetch about 35s. per ton in London; but this article would be somewhat difficult to sell in small quantities. Tabulating these results we have—

1 ton of iron blocks at £6	£6	0	0
$1\frac{3}{4}$ tons of sulphuric acid at £3 15s.	6	11	3
Total	£12	11	3

This is the actual cost, neglecting the sulphate of iron crystals, for the production of the 14,000 cubic feet theoretically obtainable hydrogen gas; but the writer has found, by actual experiment, that it is not safe to reckon on much more than 12,000 cubic feet per ton of iron consumed. The amount of crystals produced depends upon the degree of saturation of the residual liquid; the maximum quantity being only obtainable by completely working out the sulphuric acid, which it is rather difficult to do, especially without a gasholder—the absence of which the Company claim as one of the savings effected by their process. The gas is quickly evolved at first, and then fairly steady for some time, until a considerable amount of the sulphuric acid has been worked out, after which the rate at which the gas is evolved rapidly decreases; so that it is impossible to utilize all the gas evolved without a gasholder, except in the case of very small gas motors, which, of course, could go on working with the small evolution of hydrogen gas for some time. Even then, however, a limit would be reached.

The writer made some experiments with the actual generator used by the "Hawkite" Company at Bush Lane, which is a 4 ft. by 3 ft. by 3 ft. rectangular copper vessel, divided into two parts, each a duplicate of the other; the object being to work alternately, so as to secure a continuous evolution of the gas. One side of this generator will work

* Reference was made to this gas in the JOURNAL for April 11 last.—ED. J.G.L.

a Griffin 3-horse power nominal gas-engine for about two hours. Some indicator cards were taken, using the pure hydrogen, and when it was carburettor by paraffin evaporated in a suitable carburettor, which was heated by the exhaust gases from the engine passing through it. The results were 5·225 indicated horse power with pure hydrogen, and 5·74 indicated horse power with the carburetted hydrogen; while a coal-gas test with the same engine gave 6·9 indicated horse power. The brake test gave 3·28 brake horse power with pure hydrogen, and 3·5 brake horse power with the carburetted gas; whereas coal gas gave 5·8 brake horse power. The quantity of gas used was found to be 28·72 cubic feet per indicated horse power and 45·73 cubic feet per brake horse power with pure hydrogen, and 32·42 cubic feet per indicated horse power and 53·2 cubic feet per brake horse power with carburetted hydrogen; whereas with coal gas the consumption was 20 cubic feet per indicated horse power and 24·13 cubic feet per brake horse power.

The resultant crystallized iron varied in actual practice from a little over three times to a little over four-and-a-half times the weight of iron consumed; but the average may be taken from three-and-a-half to four times. If we take four times the weight of iron consumed for sulphate of iron crystals, at 35s. per ton, we have the value obtainable for the crystals—viz., £7. The writer found that the crystals, on standing in a dry place for some time, gave up a considerable quantity of their water of crystallization, and became converted into a whitish powder, consisting of sulphate of iron uncrystallized. It would not, therefore, be safe to reckon on more than four times the weight of iron consumed—even assuming that the sulphuric acid had been fairly well worked out—for it would be necessary to keep the crystals stored some time until a sufficient quantity had accumulated to make it worth selling, so that in the meanwhile much of the water of crystallization, which gives the increased weight, would disappear. Deducting £7 for the crystals from £12 11s. 3d., we get £5 11s. 3d. as the cost of production of 12,000 cubic feet of gas, or 9s. 3d. per 1000 feet. For boat purposes, it would be almost impracticable—especially for small boats—to save the sulphates, which would consequently increase the cost of production for the 12,000 cubic feet to £12 11s. 3d., or 20s. 11¼d. per 1000 feet.

Comparing these prices with London coal gas at about 3s. per 1000 feet and "Dowson" gas at about 3d. per 1000 feet, we at once see the uncommercial value of the process. But, as will be noticed from the preceding, the power obtained per cubic foot of hydrogen is considerably less than that obtained from a cubic foot of coal gas This might be expected; for, although hydrogen possesses a greater calorific value than coal gas weight for weight, yet, considered volume for volume—which is really the way to look at it, gases being always used in this manner—hydrogen has only about 195 units of heat, as compared with coal gas, which has about 6000 units of heat, or over three times that of hydrogen gas. The writer found that the explosive force of the hydrogen, when used alone, was very sharp, the action on the piston of the indicator resembling the blow of a hammer; and the hydrogen did not seem, after the explosion, to possess any body, as in the case of coal gas, the curve of expansion being very low—the pencil of the indicator dropping considerably and rapidly after the initial explosion.

The manipulators of this "Hawkite" process use paraffin to carburet the hydrogen, the utility of which the writer failed to see. He believes that it is not at all improbable that, when the carburetter was very hot, the hydrogen gas was shut off, and only air admitted to the carburetter, and that the mixture of oil gas and air would give as good, if not better, result than when oil gas and hydrogen were used; for the oil gas would supply the heating source, and the resultant gases on explosion and the nitrogen in the air would supply the elastic medium for expansion in the cylinder, which would appear to be more elastic and have more body than when oil gas, hydrogen, and air were used. This would appear to be confirmed by Mr. Dugald Clerk, F.C.S.; for, on page 104 in his book on the "Gas-Engine," he says: "Hydrogen is the very worst gas which could be used in the cylinder of a gas-engine. It is useful in conferring inflammability upon dilute mixtures of other gases; but, when present in large quantity in coal gas, it diminishes its value per cubic foot for power." In a paper written by Mr. Dugald Clerk "On the Explosion of Homogeneous Gaseous Mixtures," read before the Institution of Civil Engineers (Minutes of Proceedings, Vol. LXXXV., p. 10.), he says: "Hydrogen is not at all a good gas to use; the best mixture only producing a maximum pressure of 287 lbs. with 83 per cent. remaining after 0·2 second. . . . The difference is so great that an engine capable of indicating 10-horse power, when using Glasgow or Hollinwood coal gas, will not indicate more than 3·7-horse power using hydrogen gas. If more hydrogen were put into it to get up greater power, very great waste of heat would be occasioned."

A hydrogen flame, when burnt in an ordinary burner, has no luminosity to speak of; but the "Hawkite" manipulators use it in conjunction either with the albo-carbon apparatus, in which case the gas is carburetted by means of naphthalene vapour, or else with a Welsbach incandescent mantle and burner. The light in the latter case is fairly good; but the writer has found that the lighting and turning out of the gas causes a sharp explosion—the ignition of the hydrogen being so instantaneous—so that the delicate incandescent mantles or hoods are rapidly destroyed, the average life of these being about ten days or a fortnight; whereas in the case of coal gas, they are said to last nearly ten months. Considering the price of the mantles—viz., 2s. 6d. each—it is evident that such a method of lighting cannot be very economical.

The writer has found that there is a considerable quantity of acid vapour mixed with "Hawkite" gas; for if a moistened blue litmus paper be placed in contact therewith, it is instantly turned red. Using such a gas in the cylinder of a gas-engine must produce a most deleterious effect. The writer has noticed that this acid vapour, mixed with the liquid carried over, quickly perished a leather diaphragm in a regulator placed on the line of pipe leading from the generator. The handling of the sulphuric acid is another of the many objections to using the gas, for it quickly destroys everything it comes in contact with—such as clothes, boots, &c.—besides the danger of its splashing in the eyes of the manipulators. The cost of the generators is another serious objection, for they must be made of copper, in order to resist the corrosive action of the acid; and, comparing the price of copper with that of iron, it will at once be seen to be a most extravagant process.

EDWARD J. M. DAVIES, Wh. Sc., M.Inst.M.E., &c.

May 30, 1893.

The Correction in Mr. G. Livesey's Gas Institution Paper.—Mr. G. Livesey writes as follows in reference to our correction last week of the figures in the table (*ante*, p. 870) in his Gas Institution paper: The original mistake was so obvious, that I thought it unnecessary to trouble you to correct it; but the correction made in this week's JOURNAL [p. 1038] needs correction. I am not so enamoured of the decimal system as to use decimals of a pound rather than shillings. The figures are from Field's "Analysis": —

£11	10	average per consumer for the	London Companies.
9	6	" "	Suburban Companies.
5	8	" "	Provincial Companies.
4	6	" "	Provincial Corporations.

Mr. Alderman Pollack and the Widnes Corporation Gas Undertaking.—Writing in reference to Mr. Isaac Carr's letter on the above subject (*ante*, p. 1047), Mr. Alderman Pollack states that his reply to Mr. Bowkett was founded on the Board of Trade Returns relating to Gas Undertakings (Local Authorities), which he had before him, and in which he found the following information: Town of Widnes—price, 2s. 1d. and 2s. 3d.; outside Widnes, 3s. and 3s. 6d.; discount 3d. He adds that the returns also show that there was a loss on the undertaking in 1891.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Bills read the first time, and referred to the Examiners: City of London Electric Lighting Bill; Electric Lighting Provisional Orders Bill (No. 4); Water Provisional Orders Bill (No. 1).

Bills read a second time and committed: Aberdeen Corporation Bill; Bodmin Water Bill.

Bills reported: Barry and Cadoxton Local Board Bill; Blackpool Improvement Bill; Electric Lighting Provisional Orders Bills (Nos. 1 and 3); South Staffordshire Water Bill.

Bills read the third time and passed: Devonport Water Bill; Electric Lighting Provisional Orders Bills (Nos. 1 and 3).

Bills Royal Assented: Altrincham Gas Bill; Brighton and Hove Gas Bill; East Stonehouse Water Bill; Electric Lighting Provisional Orders Bills (Nos. 2 and 3); Ilkley Local Board Bill; Plymouth Corporation Water Bill; Sheffield Corporation Water Bill; Stirling Water Bill.

HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Bills read a second time and committed: City of London Electric Lighting Bill; Weaver Navigation Bill.

Bills reported; City of London Electric Lighting Bill; Liverpool Corporation Bill; Todmorden Local Board Gas Purchase Bill; Water Provisional Orders Bill (No. 1).

Bills read the third time and passed: City of London Electric Lighting Bill; Water Provisional Orders Bill (No. 1).

Conisbro' Gas Company, Limited.—The ordinary general meeting of this Company was held on the 31st ult. The accounts presented showed a balance of £325 on the working in the twelve months ending March 31 last. A dividend of 6 per cent. was declared; leaving a balance of £118 to be carried forward.

Laying Mains Outside a Water Authority's District.—In the JOURNAL for April 25 last (p. 735), we reported the case of *Jones v. Conway and Colwyn Bay Joint Water Board*, which came before Mr. Justice North on an interlocutory motion for an injunction to restrain defendants from trespassing upon his land for main-laying purposes. The plaintiff's contention was that the Board had no right to go upon his land at all till the easement had been purchased, or money paid into Court, in accordance with the Lands Clauses Consolidation Act. If, however, it was held that they had the right they claimed, then he submitted that, before entering upon his land, they should have given him the three months' notice required by the Public Health Act, so that he might have had the opportunity of obtaining a Local Government Board inquiry; and it was admitted that no such notice had been given. His Lordship granted the injunction; and the defendants appealed. The matter recently came before Lords Justices Lindley, Bowen, and Kay, when Mr. Byrne, Q.C., and Mr. Ashton Cross appeared in support of it; Mr. Farwell, Q.C., and Mr. Pattullo representing the respondent. Without calling upon the latter, however, their Lordships dismissed the appeal, with costs. The matter subsequently came before a special meeting of the Joint Board, when the Chairman (Rev. W. Venables Williams) explained that, in making the appeal, their contention was that they had complied with the Act by giving a "reasonable time" notice to Mr. Jones. There was, he said, an impression abroad that the Board not only lost the action, but also had to pay £700 for the land through which they desired to pass in order to lay their pipes; but the Judges of Appeal distinctly laid it down that the land had not to be bought, but compensation to be made for the easement under the arbitration clauses of the Act. The Board had offered to pay into Court £150—a sum which they had already paid for a similar easement over better land and a larger area. The issue was to depend on the Arbitrator; but the other side would not accept anything. They had only one figure in their minds—the £700; and this the Board declined to entertain. The Board had received a form from their London agents; and the meeting decided that the notice should be forthwith served on Mr. Jones.

MISCELLANEOUS NEWS.

BRUSSELS MUNICIPAL GAS SUPPLY.

Gas Committee's Report for the Past Year.

The following is an abstract translation of the report of the Gas Committee of the Municipality of Brussels on the working of the gas undertaking during the twelve months ending Dec. 31 last.

The total quantity of gas sold was 23,908,143 cubic metres, or about 847 million cubic feet, exceeding by 2,613,799 cubic metres, or about 92¼ million cubic feet, the sales in the preceding year. This considerable increase is attributable to the extended use of gas for the heating of apartments and for culinary purposes. The exceptional circumstances which unfavourably affected the working results for the year 1891 being no longer in existence, the profit realized has again become normal, and last year it rose to 1,233,233 frs. (£49,329), as compared with 801,433 frs. (£32,057) in the preceding twelve months. The gas produced reached 29,782,840 cubic metres (1051¼ million cubic feet); and it was disposed of as follows:—

	Cubic Metres.
Night gas, at 14c. per cubic metre	18,273,015
Day gas, at 10c.	3,131,685
Municipal establishments, at 10c.	878,933
Gas-engines, at 10c.	1,073,093
Industrial purposes, at 10c.	288 967
Heating purposes, at 10c.	48,873
Illumination devices, balloons, &c.	175.025
Artizans' dwellings and miscellaneous	37,952
Total sold.	23,908,143
Public lighting and illuminations	4,050,5:2
Used on the works, &c.	852,039
Unaccounted for	972,106
Total production	29,782,840

The working expenses amounted to 3,302,208 frs. (£132,088), which were increased to 3,619,882 frs. (£144,795) by the expenditure of certain sums to order. The principal receipts were as follows: Gas, 3,119,861 frs.; coke, 848,365 frs.; tar, 189,679 frs.; ammoniacal products, 131,989 frs.; spent purifying material, 35,491 frs.—other receipts making up a total of 4,812,134 frs. The balance in favour of the Municipality at the close of the year was therefore 1,192,252 frs. (£47,690); but as a sum of 40,981 frs., included in the general expenditure, had been spent in increasing the stocks, this amount should be added—making the total profit on the working of the undertaking 1,233,233 frs., as above stated. With regard to manufacturing operations, the average cost of the coal carbonized was 20 frs. 7c. per ton last year, as compared with 22 frs. 50c. in 1891. The stock of coke, which was considerable at the close of that year, had augmented by several thousand tons at the end of the period covered by the report, which was a particularly unfavourable one for getting rid of this residual. In order to dispose of the production during the current year, the Committee have had to accept lower prices. But they have deemed it prudent to restrict the make by producing a certain quantity of oil gas, the high illuminating power of which enables them to dispense with the use of cannel. The sale of coke by retail in Brussels has developed considerably. In 1880, it was 725,383 bushels; in 1886, 879,769 bushels; in 1892, 1,685,403 bushels. The breeze was worked up into compressed fuel; and the tar and liquor were disposed of by contract. A new gasholder was commenced in the spring; and it is expected to be completed during the forthcoming winter. The mains were increased to the extent of about 180,000 yards; and such was their staunchness that the leakage did not exceed 3·26 per cent. of the quantity of gas sent from the works. The number of gas appliances of all kinds placed was 1493; bringing up the total at the close of the year to 4455. There were 15 additional gas-engines fitted up; making a total of 215, or equal to about 732-horse power. The gas consumed for motive power reached 1,075,093 cubic metres, or 38 million cubic feet. In the department of public lighting, there were in use at the end of the year 5562 lamps, of which 404 were furnished with high-power burners. Of the latter, 409 are extinguished between midnight and one o'clock in the morning, as well as 383 ordinary lamps.

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Tuesday, at the London Offices, No. 60, Gracechurch Street, E.C.—Mr. J. BIRCH PADDON in the chair.

The SECRETARY (Mr. A. W. Cooper) read the notice convening the meeting; and it was agreed to take as read the Directors' report and accounts for the year ending March 31 last, of which an epitome appeared in the JOURNAL for the 23rd ult., p. 957.

The CHAIRMAN said that, in moving the first resolution, he should not detain the shareholders a very long time. The operations of the Company during the past year had been very similar to those of the preceding one—both were free from any seriously disturbing incidents, and both had contributed their satisfactory share to the strength of the business. The adverse circumstances which had applied to English undertakings had also applied to their own—such as the increased cost of coal, and the decreased value of residuals. In addition to these, the Directors had had some other matters to attend to—such as the competition of the electric light, and the very high rate of exchange. With regard to the former, it might be said that it had done them no harm up to the present time; but, inasmuch as there might be competition of some sort, he thought it right to mention two reasons why such competition could not be of any great importance. The first was that the cost of electric lighting in Malta was quite three times that of gas. Consequently, the people who would use the light there would be those to whom the expense was of little moment, and there were not many persons of that kind in Malta. The next thing was that there were no means of satisfying the consumer of electricity that he had received the volume of light for which he had to pay; and the Maltese liked to get full value for their money. Until a reduction of the cost of electricity could be made, to bring it down to the price of gas (and it was worth no more), and until some approach was made to the commercial requirement of measurement, he thought he might say that anything like permanent competition was altogether out of the question, and whatever installations were put up would only be of temporary detriment to gas companies. As to exchange, that was not the place for a bimetallist controversy. All he could say was that it was absolutely unavoidable; but it might be mentioned that, with the exception of the arrangement for the supply of the public lights at Corfu (which would expire next December), they were under no contracts or obligations to continue the price of gas irrespective of the rate of exchange. They had undoubtedly the power of increasing the price in order to meet a contingency of that kind; but he need hardly tell the shareholders that such a step was a matter requiring very serious consideration indeed. They had a set-off against these things. The accounts now presented showed that they had borne the extra cost of coal, the reduced value of residuals, and the burden of the exchange; and the price of gas had been reduced, and its use extended. With very small assistance from capital, the works had been put into a condition to meet all those largely increased requirements, and something more; and, he believed, by these substantial extensions, they had laid foundations of future security and prosperity. Two years ago, he informed the shareholders that the Directors had two objects in Malta. One (which they were very desirous of accomplishing) was the extension of the mains to Sliema; and next, the concentration of the manufacture at Valetta, so as to close the works at Calcara. Last year he reported that the Sliema extension had been finished; and this year it was his good fortune to tell them that the other, and far more important object, was practically completed. They had erected all the retorts, and made the enlargements of plant at Valetta which were required in order to produce there the gas now made at Calcara; and they had laid certainly nine-tenths of the mains between those two places. Best of all, the whole of this work had been paid for; and they would shortly enter upon a system of more economical working. He ought not to fail in acknowledging here the important facilities afforded to the Company by the representative of Her Majesty's Government there, especially as to passing through fortifications; but for these facilities, the Company would have been put to considerable trouble and expense. Trade had been bad at Malta throughout the whole year; but they had managed to increase their business to the extent of 5 per cent. Renewed efforts had been made to induce the Council of Government to establish an electric lighting installation; but the Council were exceedingly reluctant to part with their funds for any speculative purposes; and so nothing had been done. Meanwhile their Manager (Mr. Starkey), with his wise energy, had been doing all he could to popularize the use of gas. He had succeeded in introducing a number of gas-stoves, which were very favourably regarded; and it was expected that these would be gradually increased. Their Manager had also a stock of well-selected fittings of modern character, and a good staff of workmen; and he (the Chairman) thought there was no doubt they would continue to make satisfactory progress in this direction. Last year, Mr. Starkey was in London; and one of the results of the conferences between him and the Board was that, in October last, the price of gas in Malta was reduced from 4s. 6d. to 4s. 4d. and 4s. 2d. per 1000 cubic feet. Of course, it was anticipated that the rental would suffer proportionately; but, he was glad to say, the whole of the reduction had been recouped by the increased sale of gas. Of the Sicilian stations, nothing but good could be said of them. The increase there was very satisfactory indeed; and they had had to put up some additional retorts and lay more mains. At Trapini, the increase was 9·20 per cent.; and at Marsala, 13·64 per cent. Apart from the money value of these increases, the Board were very glad to have them, because they formed the most complete justification of the policy of the Directors in reducing the price of gas there. At the time this reduction was made, he believed most people looked upon it as a somewhat hazardous experiment. The Directors felt they could scarcely avoid it; and they had some anxiety as to how it would turn out. Respecting Corfu, matters were somewhat under a cloud. The question of exchange dominated the whole of the business of the island. Exchange, which they thought very high indeed last year, when it was spoken of as being 36 per cent., had in the past year been 60 per cent. The shareholders would perhaps better understand its bearing upon the gas sold at Corfu when he told them that it represented rather more than 2s. per 1000 cubic feet. Reverting to the question of the contract for the supply of the public lamps at Corfu, he said that, when it came to an end, it would be an absolute relief; but the increase in the private consumption in that town was so rapid that it would shortly require the whole of the works there to supply it. The increase during last year was 15 per cent. At all the stations, the plant had been well maintained, and was in good working order. It was not too much to say that, during the last few years, they had succeeded in quite doubling their capabilities in respect to manufacture and distribution. They had not done so with regard to storeage, because at Calcara they had abandoned an old gasholder. As soon as the Company could afford it, another gasholder would be constructed at Valetta. Turning to the accounts, the Chairman said they needed very little explanation. Looking at the balance-sheet, it would be seen that they had increased the debentures by £3000; but, on the other side, it would be observed that the capital expended during the year had been £3487. It would also be noticed that the sum of £3000 had been deducted from the reserve account, and placed to the credit of the capital expended on the other side, in accordance with a suggestion from the Auditors. As to the profit and loss account, the first item, "Coal, £11,209," was £1185 more than last year; but this was accounted for, first, by there having been an extra 924 tons used, and, second, by an increase of 7¼d. per ton in the price over the whole year. Exchange was £1027 more, or very nearly double what it was in the preceding year. Adding these two increases together made £2212. Now the total revenue debits were about £1097 more than in 1891–2; but, as the two items mentioned amounted to £2212 more, it followed that the

whole of the charges were some £1114 less. Giving a few details as to the working, he stated that 12,325 tons of coal had been carbonized, from which they had made 125,602,000 cubic feet of gas, which was at the rate of 10,190 cubic feet per ton of coal. Of this quantity, 112,000,000 cubic feet were sold, being at the rate of 9109 feet per ton. The difference between the quantity made and sold was 13,000,000 feet, which worked out at the rate of 10·68 per cent. This was rather high, but it was not quite so high as the previous year, when it was 11·15 per cent. However, this included the whole of the gas used at their five stations; and if they deducted 2½ per cent. for this, it would reduce the figure considerably. Last year, too, he mentioned that the Directors, looking at the chances with regard to the electric light, had put up, at Malta and Corfu, some superior lamps, which consumed a great deal of gas, for which they did not get paid. Still the Directors thought it desirable that they should continue to light these lamps for the present. This, however, took away a great deal of gas; and, in point of fact, it reduced the amount actually lost to a smaller percentage. As to the gas-rental, notwithstanding the general reduction in price, there had been an increase of £1039, which was 3¾ per cent. more than previously; and if no reduction had been made, they would have had quite double this percentage. Concerning residuals, on coke £534 had been lost; and on tar, £76—together £610. On fittings, they had an increase of £103, which was not a large amount, but still it was more than 6 per cent.; and it kept pace with the increase in the consumption of gas. The resulting profit enabled the Directors to place the usual sum to the reserve account, to pay the ordinary dividends, and to carry forward the sum of £1421. Last year £2412 was carried forward; but then they had much more to provide for than they had now. The prospects of the Company were decidedly better now than then. They hoped to save something on the rate of exchange, either by a reduction of the rate or in some other way. The Directors knew they would have a large reduction in the cost of coal; and they did not at present contemplate any immediate lowering of the price of gas. If all these things were considered, it would not be unreasonable to look for some improvement in the dividends on the ordinary shares. He concluded by moving the adoption of the report.

Colonel J. Le Geyt Daniell seconded the motion.

Mr. R. Hesketh Jones remarked that he thought the question of the probability of paying a dividend of over 6 per cent. might well be shelved for the present. Personally, he would like to see the Company in a more healthy position before they attempted to pay an increased dividend.

The Chairman said, with regard to the payment of a higher dividend, he had no doubt the Directors would be guided by the facts which existed when the time came; and he thought he might confidently appeal to the past policy of the Board to show that they would not take any very extravagant or unreasonable step in that direction. In reply to questions which had been put by Mr. Watson, he stated that the audit at the various stations was carried out by gentlemen appointed by the Board; and their audit was further checked by the Company's Auditors in London. The reserve fund was not invested; he wished it was. Its object had been first of all to reduce the value of the capital expended at the various stations; and next to provide something to secure them against inequalities of dividend. At the present time, the whole of it had been expended; and it did not exist except as an account. When, however, he mentioned that, although they had reserved £17,500 in that way, they had paid off debentures to the extent of £19,775, this would show where the reserve fund had gone. The Directors, he added, were not insensible to the value of a reserve fund; and they looked forward, with hope, to the time when it might be invested, in some tangible form, so as to equalize dividends when required. Then, with regard to a further inquiry from Mr. Watson as to the expiration of the contract for public lighting at Corfu, he again explained that its termination would be a relief to the Company, on account of the high rate of exchange, as the contract was upon an old-established price. The contract really came to an end two years ago; but they had since been going on in a sort of hand-to-mouth way of supplying the public lights, in consequence of a contract having been entered into for lighting the streets by electricity. This had been under negotiation for two years; and it was not absolutely completed yet. During that time, however, the private gas consumption had increased, so that it had removed all danger of a portion of the works being thrown on their hands; but, if they had to supply the public lights, the works could soon be sufficiently enlarged for that purpose.

The motion was unanimously carried.

On the proposition of the Chairman, seconded by Mr. J. Orwell Phillips, dividends were declared at the following rates: 7 per cent. on the first preference capital, 7½ per cent. on the second preference capital, and 6 per cent. on the ordinary shares, less the payments already made on account.

Mr. Stephenson R. Clarke was re-elected a Director on the motion of Mr. Newbery, seconded by Mr. Harvey; and the Auditors (Messrs. R. H. Jones and T. Guyatt) were re-appointed, on the proposition of Mr. Cash, seconded by Mr. Smith.

Mr. Watson proposed, and Mr. Simmelkjör seconded, a vote of thanks to the Chairman and Directors and the various officials for their services; and it was unanimously carried.

The proceedings then terminated.

The Guiseley Local Board and the Water-Works.—At a meeting of the Guiseley Local Board on the 31st ult., a letter was read from the Secretary to the Guiseley Water Company, stating that the Company could not accept less than £1 3s. per £1 share for their works; this being the amount agreed upon at a full meeting of shareholders. The Board had offered £1 per share, subject to the approval of the Local Government Board being obtained to the purchase. Mr. Preston, the Board's Engineer, said the Local Government Board would never consent to the Board purchasing the water-works until they possessed some definite information as to the quantity of the supply; and it was therefore decided to leave the matter in abeyance until this information could be obtained.

COVENTRY CORPORATION GAS SUPPLY.

Annual Report—Gas Profits and the Relief of the Rates.

At the Meeting of the Coventry City Council last Tuesday—the Mayor (Mr. Alderman Singer) presiding—the annual report of the Gas Committee was submitted. It stated that, after providing £1442, the year's payment into the sinking fund, there was a net surplus profit of £1103 available for the general district fund in relief of rates, as against £309 last year and £2015 the year before. The price of coal, it was mentioned, had shown a slight decrease; but the market for residuals had continued very much depressed. But for this latter fact, the profit would have been considerably larger. The sale of gas had remained practically stationary; the increase over last year being only 0·8 per cent.

Mr. Andrews, the Chairman of the Gas Committee, in moving the adoption of the report said the substance of it was that, after paying the final instalment on the retort-houses and other liabilities of that sort, there was a profit of £1103, which went in relief of the district rate. Generally speaking, the figures showed a shrinkage, with one exception, and that was the increase in the consumption of gas. The increase in the past year had been something like 3 million cubic feet, or about 1 per cent. increase on the preceding year. The figures of the other items, as he said, showed a shrinkage. For instance, the Committee paid for coals £600 less; for purifying materials, £300; salaries, £180; wages, £200; and repairs and renewals, £1200. On the other hand, they received £230 more for gas. The residuals brought in less—coke, by £150, breeze, by £234, and tar, by nearly £1400. The last item was a great drop; whereas this year only £850 was received for tar, £2229 was the amount in the previous year. The Council would therefore see that, but for the falling off on this item, the available surplus would have been considerably more than it was. He might say that during the year the capital expended had been—on new buildings, £716, and £250 the final instalment on the gasholder. Then £553 was spent on a mile of new mains; and £123 on new meters. Altogether, the capital outlay had been £1393. Out of the revenue £12,927 had been paid to the sinking fund, £5000 to the reserve fund, £729 had been used in paying off gas certificates, and the balance of £1103 was available for the district rate. The sum this year set aside for that purpose gave, for the eight years the Corporation had had the gas undertaking in their hands, £8000 or £9000 set apart in relief of the district rate; or rather more than £1000 per annum, taking one year with another, or nearly 2d. in the pound. He did not think he had more to tell the Council, except that there was some hope of a larger surplus next year, because it was certain coals would cost less; and it was not likely that the amount received from tar would decrease. They might even look for more, because the new inclined retorts would be used next winter; and they would considerably economize the cost of labour. He thought the Council would say that, under all the circumstances, £1103 was a satisfactory amount to be handed over to the rates.

Mr. Pulley seconded the motion.

Mr. Wormell remarked that the retort-houses in other towns differed materially from those which had been erected in Coventry; and he thought the Gas Committee were too much given to experimenting. In these experiments, whether they were a success or a failure, the Committee stood to lose.

Mr. Andrews, in reply, stated that the inclined retorts were a success. He mentioned that, only a few months ago, a visit was paid to the Coventry works by a number of gas engineers purposely to examine these retorts; and all of them expressed their great satisfaction with the efficient way in which they worked.

The report was passed.

Alderman Tomson subsequently moved the following resolution: "That, inasmuch as the credit of the ratepayers of the city has been pledged to raise £53,620, part of the capital employed in the gas undertaking, it is, in the opinion of this Council, equitable that the price of gas should be so regulated that the working of the undertaking may show in each year an estimated profit equal to at least 2d. in the pound in relief of the general district rate." He said that notwithstanding the interesting and fairly satisfactory report which they had just heard from the Gas Committee, he still thought that the resolution standing in his name ought to be brought before the Council, and receive their very earnest attention. He maintained that the proper adjustment of the relations between the profits of the gas undertaking and the ratepayers, on the one hand, and the consumers on the other, had never been thoroughly considered and settled by the Council. On the occasion of the making of the last district rate, he called the attention of the Council to the fact that, if the profits of the gas-works had been the same as in the previous year, the rate would be 2d. in the pound less. The Chairman of the Gas Committee then stated, in effect, that there was no order or resolution of the Council that a surplus for the relief of the rates should be considered as part of their obligation; and it was this omission which he desired to supply by the resolution. Besides the responsibility for the £53,620 incurred by the Corporation on behalf of the gas-works, there were reasons, real, though not apparently imminent, for loss which might have to be made good by the Corporation. He thought that the proper policy was to give a fair consideration to these possibilities; and he considered that some advantage should accrue to the ratepayers before the price of gas was reduced to the lowest possible minimum. He thought that he should be able to show that this was the idea of the Council when they purchased the gas-works, and that, in practice, the Gas Committee had generally acted up to it; but he feared the tendency now was towards ignoring the claims of the ratepayers, and to look at the gas undertaking as a business entered into by, and for the benefit of, consumers only. In seconding the proposition for the purchase of the gas-works on March 25, 1884, Mr. Andrews said: "He had no reasonable doubt they would be able to make something like a clear profit of £2000 or £2500 a year when the matter was in thorough working order, and that the gas-works would turn out to be as advantageous and as good a property to the ratepayers as the water-works." Alderman Lynes, in opposing the purchase, said: "Mr. Andrews says we are going to make £2000 a year profit. I have no doubt you will, by keeping up the present price of

gas (3s.); but reduce it, as you ought, to 2s. 6d. or 2s. 3d., and where will your £2000 be? If you are going to make a profit, you will keep up the price to make it; but I contend that it ought to come down, and might come down." Thus it would be seen at that early stage the two sides of the question before them were presented clearly and forcibly; and it was wonderful what a difference such opposite points of view made in one's argument. In presenting the report of the Gas Committee on May 22, 1888, Mr. Andrews, expressing his own personal feelings, but not speaking on behalf of the Committee, said: "His view was that, in dealing with any surplus in future, those inhabitants who provided that surplus should have the first claim to consideration; and after they had been considered, the district rate came next." The price of gas was then 3s. per 1000 cubic feet. After quoting from the Gas Committee's report on electric lighting, submitted on Aug. 1, 1889, he said he thought they established his contention that, besides finding the money in the expectation of a profit, the ratepayers did run some risk of loss, and should therefore feel secure of a present benefit from the undertaking. He would not confine this principle to the Gas Committee. He thought that, if the Council undertook any business that could be carried on by private enterprise, it should be for the benefit of the whole, and not of only a part, of the community. As to the electric light, he would apply the same principle; and, allowing for a year a two to get in working order, it should certainly be a source of profit and not of loss. As they often obtained useful hints by interchange of views with other towns, he asked the Town Clerk to get from the principal corporations who owned gas-works a statement as to their ideas and experiences in this matter, with the following results: He had obtained returns from twenty-one towns owning gas-works as to their practice with reference to the profits. He might say that in reply to the question: "Is there any standing order, resolution, or recognized rule of practice requiring gas-works to provide annual profit for relief of rates?" nearly all answers were in the negative. In reply to the further question: "Do the gas-works usually provide such a profit?" the reply was "Yes," with the exception of Hereford. After giving the figures, he said the members of the Council would see that in every case, excepting Hereford, the ratepayers reaped a benefit from their gas undertaking—most of them far in excess of that which he proposed as a minimum for Coventry. Of course, reason told them that they must not "kill the goose that laid the golden eggs" by a suicidal demand for large profits, and that the interests of the manufacturers, upon which their prosperity so much depended, should be met as far as was justifiable. He trusted the moderate proposal he had made would prove that he had not lost sight of the fact; and he hoped it would be acceptable to the Council and the city at large.

Mr. SMITH seconded the motion.

Mr. ANDREWS observed that the Gas Committee were quite neutral in the matter. It was for the Council to take the responsibility upon themselves, and decide to what extent the consumers should be made to provide a surplus for the district rate; but the Committee would carry into effect their decision, so far as they could. On a former occasion, it was pointed out that, out of 11,000 householders, only one-half of that number consumed gas; so that the surplus profits which went to relieve the rates were really provided by the consumers for those who only burnt petroleum. The resolution was fair and reasonable in many ways; and the amount proposed to be set aside was not excessive, for the profits, taking one year with another, were equal to about 2d. in the pound. The opinions expressed prior to the purchase of the undertaking as to the probable profits had been fully borne out. Had the price of gas not been reduced, but kept at 3s., the profits would have reached the estimate of £2500 per year; and the whole of the expectations and inducements held out to the Council and the ratepayers in favour of the purchase of the undertaking had been realized. The resolution as it stood would be rather a difficult one for the Gas Committee to carry out, for, by the stupid decision of the Government that the accounts were to be made up on March 31 instead of Dec. 31 of each year, it was almost impossible to estimate what would be the profits for the next twelve months. Two heavy quarters came in one twelvemonth; and as the profits depended upon the condition of trade in the winter, the difficulty of estimating the profits was increased. The prosperous or the depressed condition of the watch trade during next winter would make a difference to the gas undertaking of £1000. Alderman Tomson was wrong in stating that any loss would fall upon the general body of ratepayers, for any deficiency would be met by an increased price of gas.

Mr. JAMES said he was sorry not to be able to support the Chairman of the Finance Committee; but he thought it not quite fair to saddle a Committee with the responsibility of raising money in relief of the rates. He should be glad to know if Alderman Tomson had considered who were the ratepayers that were going to be most relieved by a rise in the price of gas—not the better class, for about half the total number of ratepayers were not consumers of gas at all; but it would be the owners of tenementary property. Already the Council spent a large amount of money in looking after tenemental property; and he did not think the owners ought to be further relieved from rates.

Mr. BAND was of opinion that the motion was both illogical and unfair, and pointed out that people who consumed electricity would not only get a reduction of rates, but would get it without contributing towards the expenses of the gas undertaking. If there was a decrease in the consumption of gas, and an increase in the use of electricity, it followed that the price of the former must be raised to provide the money asked for by the motion.

Mr. LEE also objected to the resolution. If it came into operation, a person who consumed 100,000 cubic feet of gas would pay 2d. per 1000 more for his gas, or 16s. 8d.; and all he would receive in return would be 5s. reduction on his district rate. One effect of carrying the motion would be, he believed, to induce some people to manufacture their own gas; and consequently there would be a diminution in the quantity consumed from the gas-works. The Gas Committee had managed the works splendidly ever since they had been in the hands of the Corporation; and he did not think any good would be obtained by interfering with them now.

Mr. CALCOTT opposed the motion chiefly on the ground of the benefit to tenement owners. There were persons in the city, he said, who owned 100 or 150 small houses each; and their tenants would not contribute more than £4 a year for gas. Yet these owners were to be benefited to the extent of 2d. in the pound on the district rate. He reminded the members that the surplus gas profits were really more than set forth in the report, because there was a loss of 10s. per annum on every gas-lamp.

Mr. GOATE was in favour of the resolution, because the gas-works were purchased for the benefit of the ratepayers as a whole; and therefore the profits ought to go to the entire body.

Alderman TOMSON, in replying on the discussion, said the resolution was a reasonable, logical affirmation of a principle—a principle that he took to be perfectly sound and good; and, if they did not see its wisdom at present, he believed they would in future years. Mr. Andrews's statement that only half of the householders used gas strengthened his argument rather than otherwise; for the Council did not purchase the undertaking for the benefit of half of the community, but for the whole. He alluded to the admirable way in which the Gas Committee performed their work in the past, and said he did not apprehend any difficulty like the one Mr. Andrews had mentioned in carrying out the resolution if it was adopted. There was a possibility of loss; and he contended there ought to be some guaranteed benefit.

The resolution was rejected by a large majority.

LINCOLN CORPORATION GAS SUPPLY.

Annual Financial Statement—Reduction in the Price of Gas.

At the Monthly Meeting of the Lincoln City Council last Tuesday, the Gas Committee recommended that £2000 should be transferred from their revenue account to the reserve fund, and that the price of gas should be reduced to 2s. 4d. per 1000 cubic feet, as from Sept. 29 next. In moving the adoption of the minutes, the Chairman of the Gas Committee (Mr. W. T. Page) said perhaps it was only right on an occasion when some slight change was being made in the charges for the future, that he should say a word in explanation of the financial position of the Committee. The undertaking, as was well known to the Corporation, had been tolerably successful. The results, subject to audit, had been made out for the year ending March 25; and he thought they might fairly be presented. The gross profit for the year was somewhat in excess, though only slightly, of the preceding year; being £10,505, as compared with £10,277. The income, therefore, though exceedingly good in the gross, showed not a very great, but still a satisfactory increase. When they came to the net results, after adding to the sinking fund, and paying all charges due out of gross revenue, there was a net profit of £2508, as against £2131. At the present time there was standing to the credit of the current revenue account a sum of about £2750. The gas undertaking was bought in the year 1885; and the Corporation gave for it, in round figures, £191,000. For this they received the undertaking in the condition in which it then existed, and a sum of money amounting to about £9000. They had now been in possession of the works eight years; and during that time they had paid to the sinking fund about £15,000. This was the amount which had actually been paid on account of the purchase-money out of the profits of the undertaking; and the ratepayers thus held a stake of £15,000 in the concern. In addition to this, the £9000 which came into the hands of the Corporation at the time of the purchase, would be increased, if they accepted the recommendation of the Committee that day, to a total of £17,000. But this was not all. The consumers had gained £550 a year by the reduction of meter-rents from 1s. to 6d. a quarter; and the reduction of 2d. per 1000 feet in the price of gas two or three years ago had benefited the consumers to the extent of £1400 a year—making a total grant already to the consumer of £1950 a year. Under these circumstances, having regard to the profit they were now making the amount standing to the credit of the revenue account, and the estimate of profits for the current year, the Committee had considered, and he thought rightly, that the reserve fund which now stood at £15,000 should be increased to £17,000; the ultimate hope of the Committee being, and he trusted in the future it would be realized, to raise the reserve fund to a minimum of £20,000, believing that it should stand at a sum not less than 10 per cent. upon the value of the undertaking. Then having regard to the profit during the last two years of considerably over £2000, and the prospects of the current year, although it was perhaps not always judicious to divide profits before making them, they recommended a reduction in the price of gas. The profits of the concern depended to a great extent on the contract price which they gave for coal; and the Committee, having regard to the fact that the coal contracts, amounting to 22,000 tons, had been made at a large reduction on the price given last year, they might safely rely on receiving a profit of £2500 during the current twelve months. Looking to this fact, and also that they were carrying forward £750, it was felt the time had arrived for the consumers again to be encouraged in the use of gas; and the Committee proposed to make a further sacrifice of £1400 a year in their favour. He thought, when they came to see the balance which was being held between the Corporation in the interest of the ratepayers who owned the undertaking on the one hand and the consumers on the other, they would agree it had not been an unfair arrangement that the ratepayers should have obtained a stake of £23,000 out of the profits, and that the gas consumers should be receiving something like £3350 a year, if they accepted the recommendations of the Committee that night. In making this reduction, they must recollect that the consumer paying most to the gas-works was the Corporation in its capacity as the Urban Sanitary Authority, from whom they received £2000 a year for lighting the public lamps—an amount which would be proportionately reduced. Then he might say that they were very anxious to encourage, and so far they had been successful, the use of gas for other than illuminating purposes. In recent years there had been other lights in competition with gas; and in view of this, it was satisfactory to note the large increase which was taking place in the use of gas for heating and cooking purposes and as a motive power. Those uses apparently continued to be very largely on the increase, and there was a future in store for gas as a motive power. They were anxious to give every possible encouragement to the use of gas for other than illuminating

purposes; and last year there had been an increased income from that source. Prior to the Corporation taking over the works, there was an enormous income from residuals; but since then they had fallen in value. For the current year there was the prospect of a rise; so that on the whole the outlook was hopeful and bright. In concluding, he said that, so far as the Gas Committee and their able Manager (Mr. J. Carter) were concerned, every effort was made to supply the very best article that could be produced. Mr. Cannon seconded the motion; and the minutes were then confirmed.

SALFORD CORPORATION GAS SUPPLY.

Annual Report.

The following is an abstract of the report of the Gas Committee for the year ending March 25 last, which was submitted and adopted at the meeting of the Salford Town Council last Wednesday: During the past year an additional 5157 yards of new mains have been laid; and also 2721 yards of new mains, which replaced others of less dimensions. The amount of coal and cannel carbonized was: Coal, 70,237 tons; cannel, 35,962 tons—total, 106,199 tons; the proportion of cannel being 33·86 per cent. The average yield of gas per ton of coal was 10,469 cubic feet. The gas used on the works and in the offices, &c., amounted to 10,409,000 cubic feet; being 0·94 per cent. of the quantity made. The gross profit is £38,194. The Committee have pleasure in reporting that the results of the year's working have, on the whole, been very favourable. The output of gas was 53,719,000 cubic feet more than in the previous year; being an increase of 5·08 per cent. Notwithstanding the reduction of 2d. per 1000 cubic feet in the price of gas in the out-districts, which commenced last June, the revenue from the total sale of gas has increased by £4179. There has also been an increase of £222 in meter and stove rental. There is a decrease in the receipts for coke of £410, although nearly 10 per cent. more has been sold. Against this falling off in price, it is satisfactory to note that the cost in yard labour of handling the coke this year has been £178 less than last year, owing to the improved accommodation for loading and storeage at the Liverpool Street works. There is a decrease in the receipts for tar amounting to £3151; while the quantity sold has increased by 9 per cent. The Committee hope to get a better price for this residual as soon as the present contract expires, which it will do in a few months. The sulphate plant has been working very satisfactorily; and there is an increase of £897 in the receipts for ammonia. There has been a reduction in the cost of coal—including unloading—amounting to £1153, notwithstanding that 2970 tons more coal have been used and the percentage of cannel has been increased. This is mainly due to the saving effected by the hydraulic machinery used in unloading the coal. It is gratifying to note that, owing to the improvements in the carbonizing plant, there has been a very large yield of gas from the coal, averaging 10,469 cubic feet per ton, or an increase of 246 feet compared with last year. The Committee have advertised for tenders for the buildings, engines, machinery, mains, &c., for the electric installation; and in a few weeks the work will be started.

THE WEST BROMWICH CORPORATION GAS UNDERTAKING.

In the JOURNAL for the 30th ult., we gave the annual report which the Secretary of the West Bromwich Corporation Gas Undertaking (Mr. Thos. Hudson) had lately issued. Accompanying the report are the accounts for the past financial year (to March 31 last); and following them are a series of tables furnishing statistics in regard to the undertaking from the commencement. The principal figures in the former are embodied in the report; but, as those in the tables show the progress of the business year by year, it may be interesting to extract a few of them by way of supplementing the particulars already given. Although the first figures given are for the year 1880-1, we will take those for the beginning and end of the past decade. Starting with the capital expenditure, we find that, in the year 1883, it amounted to £151,266; being £873 per million cubic feet of gas made, 18s. 9d. per 1000 feet sold, and £8 18s. 3d. per ton of coal and cannel carbonized. In 1893, these figures were £190,161, £892 18s. 11d., and £9 0s. 6d. respectively. In 1882-3, the amount of gross profit realized was £12,457 18s. 4d., of which £6181 16s. 10d. was required for interest, £800 went to the sinking fund, £1500 to the depreciation fund, £3000 to the relief of the district rate, and £141 to pay for the illumination of the public buildings in celebration of the incorporation of the borough. The amount of gross profit made last year was £8386, of which £5596 and £2658 went to meet interest and sinking fund payments; the balance of unexpended profits in the hands of the Gas Committee on March 25 last being £9070. For the three years 1886-8, nothing was used to relieve the rates. Since then £1000 has been the sum usually appropriated for this purpose; and in 1889-90, £1000 was added to the depreciation fund. Out of the total of £122,244 profit made since the commencement of the undertaking, £74,615 has been paid for interest, £16,917 has gone into the sinking fund, £4000 into the depreciation fund, and £17,641 in relief of the rates. The quantity of gas made in 1882-3 was 173,266,000 cubic feet, of which 161,321,700 cubic feet, or 93·16 per cent. of the make, were sold; the gas unaccounted for being 5·9 per cent. of the production. The gas sold yielded £20,205 14s. 4d., or an average, excluding the public lighting, of 2s. 5·50d. per 1000 cubic feet. Last year the make was 213,078,000 cubic feet, of which 200,686,000 cubic feet were sold, and 10,762,000 cubic feet were not accounted for; being respectively 94·18 and 5·06 per cent. of the make. The sales produced £25,483 7s. 4d., or an average, leaving out the public lighting, of 2s. 5·90d. per 1000 cubic feet. The prices last year were 2s. 8d., 2s. 6d., 2s. 4d., and 2s. 3d., as compared with 2s. 9d., 2s. 7d., 2s. 5d., and 2s. 3d. in 1882-3. It should be mentioned, however, that from 1884 to 1886 the price was about 4d. per 1000 cubic feet lower all round. The comparative and analytical statement, showing the quantity of coal and cannel carbonized, and the products obtained furnishes a great deal of information. Taking again the year 1883, we find that the 16,967 tons of raw material cost, including delivery, £8190 14s. 1d., or an average of 9s. 7·85d. per ton. The quantity of gas produced was, as stated above, 173,266,000 cubic feet, or 10,212 cubic feet per ton. The residuals were: Coke and breeze, 10,798 tons; tar, 199,300 gallons; ammoniacal liquor of 10-oz. strength, 444,600 gallons. Per ton of coal carbonized, the figures are: Coke and breeze, 1424·64 lbs.; tar, 131·48 lbs.; ammoniacal liquor, 267·93 lbs. In the past financial year, the raw material dealt with weighed 21,066 tons, costing £13,682 1s. 10d., or an average of 12s. 11·76d. per ton. The quantity of gas made was 213,078,000 cubic feet, or 10,115 cubic feet per ton; the residuals produced being: Coke and breeze, 13,738 tons, or 1460·17 lbs. per ton; tar, 268,715 gallons, or 142·85 lbs. per ton; and ammoniacal liquor, 672,448 gallons, or 324·95 lbs. per ton.

At the Meeting of the West Bromwich Town Council last Wednesday—the Mayor (Mr. C. A. Akrill) in the chair—the annual report of the Gas Committee, alluded to above, and dealt with at greater length in the JOURNAL a fortnight ago, came up for consideration. The Chairman of the Committee (Mr. Alderman Farley), in moving the adoption of the report, remarked that, as there was nothing to go in aid of the rates, he thought it would be well to look for a few minutes at the work of the Gas Department during the past year. The total profits amounted to £8386; but, after paying the interest on borrowed capital and making provision for the sinking fund, there was a surplus of only £131. Out of this it was impossible to employ anything in relief of the rates. For four years in succession, the Committee had been able to hand over for that purpose to the Council £3000 from the gas undertaking; and the question might be asked, if this was the condition of things in the earlier years, how was it that now, with a larger consumption of gas and increased business, the Committee could not do the same thing. Well, during the last few years, the price of coal had risen very much, and more had to be paid for labour. There were also reductions in the value of the residual products. The total quantity of gas sold in the year ending March, 1889, was 179,127,000 cubic feet; and the sum paid for coal was £8904, which gave an average price of 9s. 8d. per ton. Last year the quantity of gas sold was 200,686,000 cubic feet; and the amount paid for coal was £13,682, which gave an average price of 12s. 11¾d. per ton. If the price of coal had been the same last year as in 1889, the amount paid would have been £10,182; so that there was a difference of £3500 on the item of coal alone. The whole of this increase did not go either to the colliery proprietors or to the colliers; but part of it went to the railway companies, who in previous years had carried 21 cwt. to the ton, which would make a difference of £1000 all round on the quantity of coal carbonized last year. In the year he was taking, the carbonizers' wages amounted to £1889; and the quantity of coal carbonized was 18,410 tons. The wages last year amounted to £3140; and the quantity of coal carbonized was 21,066 tons. If wages had been the same last year as in 1889, before the adoption of the eight-hour shift, the stokers' wages would have been £2164, instead of £3140, which was an increase of £976. The Council being allowed 41 years in which to repay loans was a great advantage, not only to the Gas Committee, but to every other Committee of the Council. They were thus able to get money cheaper. If the circumstances had remained the same as in the previous years, it would have been an easy matter for the Committee to allocate £3000 to the rates, as they had done in former years. He compared the prices charged for gas with those of other towns, and stated that the difference between the figures at Oldbury and West Bromwich was £3937 on the year. By this he meant that, if the same prices had been charged at West Bromwich as at Oldbury, the income of the former would have been £3937 more. Compared with Tipton, there would have been an increase of £1400; and with Smethwick, £3012. He understood that the Tipton Local Board had decided to increase their price 3d. per 1000 cubic feet. He thought it was well that these facts should be placed before the Council, so that everyone should know that the present circumstances had arisen through no fault of the Committee. They sincerely hoped that they would be able to struggle on without any assistance from the Council. They were making improvements at the gas-works in order to effect economy. Alderman Heelis seconded the motion. He expressed the opinion that the Committee ought not to raise the price of gas with a view to creating a larger profit to aid the rates, which would benefit those who consumed small quantities, as well as those who did not burn gas at all. Mr. Pitt said he could only remember one occasion when the working result was so low as it was in the past year; and he hoped they would soon be able to overcome the difficulty. It appeared a very serious matter that, out of a turnover of £37,000, only £130 was to the good. It was quite true that the price of coke had gone down; and they all hoped for better times. They could not expect a very big profit when the gas was made at a cost of 2s. 6d. per 1000 cubic feet, and delivered to the consumers' premises at 2s. 3d.—the consumers being allowed 5 per cent. discount on this. The Mayor remarked that Alderman Farley had made a very interesting statement. He calculated that, if things had remained the same last year as in previous years, they would now have had a balance in hand of something like £4500. When the improvements referred to were carried out, the gas-works would compare favourably with any in the country. Alderman Farley said that, by taking over the gas undertaking, the Council had gained great advantages; and yearly they were saving £2658. They had now built up a working capital of £9070; but they were at present spending a large amount in extending the works, and were doing it as economically as possible. He was sure the Committee would do all in their power for the welfare of the borough. The report was adopted.

Additional Capital for the Maidstone Water Company.—At a special general meeting held last Thursday week, the Maidstone Water Company decided to raise additional capital to the extent of £5000—£4000 to be issued at once, in preference shares, and the remainder as required—to meet the increased business of the Company. The town mains are to be enlarged from 3 to 6 inches in diameter.

BURY CORPORATION GAS SUPPLY.

Annual Report and Accounts—Advance in the Price of Gas.

At the Meeting of the Bury Town Council on the 1st inst., the annual report of the Gas Engineer and Manager (Mr. W. H. S. Gendall) was submitted. It was stated therein that, owing to the mills working short time during the lighting season, the consumption of gas had decreased to the extent of 2,577,000 cubic feet. Of the 295,310,000 cubic feet of gas made, 250,128,175 cubic feet were sold for private consumption, 22,278,600 cubic feet for public lighting, and 3,532,600 cubic feet were used on the works—making a total of 275,939,375 cubic feet, and leaving 20,370,625 cubic feet, or 6·8 per cent., unaccounted for. This was practically the same as in the preceding year. During the twelve months covered by the report, the Lighting Committee had provided 105 new lamps; making a total of 2010 lamps served from the mains. There were 308 gas cooking-stoves hired, which had given every satisfaction; and 31 stoves had been sold and fixed. The Gas Committee had introduced 27 prepayment meters into cottages where gas had not been previously consumed; and it was estimated that the occupants of about half of the 2000 houses in which gas was not burnt might be induced to try them. Coke had increased in value; and the price for tar products was increasing satisfactorily, with the exception of pitch. Sulphate had again been low; but the present selling price was £2 per ton higher than at this time last year, and the outlook was good. The statement of working which accompanied the report contained the following figures. Cost of manufacture, distribution, management, &c., per 1000 cubic feet of gas sold, 2s. 5·48d.; less tar, sulphate, coke, meter-rents, &c., 9·28d.—leaving 1s. 8·20d. Adding interest on loans stock, and sinking fund contribution, 7·50d, the net cost of gas came to 2s. 3·70d. The net amount received was 2s. 2·90d.; showing a loss of 0·80d. The estimates for the current year are as follows: Cost of manufacture, &c., 2s. 5d.; less tar, sulphate, coke, &c., 9d.—leaving 1s. 8d. Adding interest, 7·5d., the amount is brought up to 2s. 3·5d. The works are in good condition; and if the cotton strike had not taken place, Mr. Gendall is of opinion that an increased consumption would have been met in a satisfactory manner. On Aug. 29 last, West's stoking-machine was started; and it worked very satisfactorily all the winter. On this report, the Gas Committee recommended that the price of gas to consumers within the borough (except the added areas) be 2s. 4d. per 1000 cubic feet, less 1d. for prompt payment, and to consumers in the added areas and outside the limits of the borough, 3s. 1d. per 1000 cubic feet, less 1d. for prompt payment; and that the Manager be empowered to supply prepayment meters whenever demanded. Mr. Byrom moved the adoption of the Gas Committee's minutes. He explained that they had been compelled to put 1d. per 1000 cubic feet on the price of gas, owing to having during the past twelve months had something like £1000 to pay for interest on capital which had been unremunerative in consequence of the railway siding being unfinished. This had taken the whole of the profit of the last year; and they had incurred a loss on the gas-works through this and the extra price for coal which they had to pay under contracts made in August. It cost 9½d. per ton more; and this year they had a loss of something like £900, which had been taken from the reserve fund. The penny had been added to cover the loss and allow of a small profit being shown next year. The instructions of the Council were that the Committee should not make a large profit, in consequence of the way in which it had to be used—one-half going to the gas consumers, and the other half to the general rates. It also saved income-tax on profits. The motion was carried.

TIPTON LOCAL BOARD GAS SUPPLY.

The Annual Accounts—Increase in the Price of Gas.

At the Meeting of the Tipton Local Board on the 30th ult., the Gas Committee presented their annual statement of accounts for the year ending the 25th of March last, which they recommended for adoption. The Chairman (Mr. D. Hipkins) in explaining them, said the amount borrowed up to the present time was £79,100; and the amount repaid, £6759—leaving the present debt at £72,341. In addition to this, they had expended out of the profits £2328; making upwards of £9000 paid towards rendering the undertaking the property of the ratepayers. During the past year, £314 more had been expended upon repairs, maintenance of mains, &c., than in 1892. The rates and taxes had also been considerably more, owing to the income-tax for two years being paid last year, and to increased assessment. There had been a slight falling off in the gas consumed—the quantity sent from the works being 94,633,199 cubic feet, as against 96,546,568 cubic feet in 1892; and there had been a corresponding decrease in the quantity of coal carbonized, materials used for purifying, and the labour. The reduction in the volume of business—amounting to only somewhere about 2½ per cent.—was not of much consequence. A more serious question was the fall in the value of the residual products, which last year only realized £3477, as against £4055 in 1892; being £578 less. On taking into account the reduced make of gas, the loss was £563—a very serious one in so short a time. On the fittings account they had made less profit by £53 than they did in 1892. Therefore, although there had been a gross profit of £3494, it was less by £771 than in 1892, and was not sufficient to cover the interest and instalments of repayment of loans by £617, which was the amount of the loss on the undertaking during the year. This was almost accounted for by the fall in the value of the residuals alone. The drop in the profits was due to this cause. In 1884 the consumption of gas was a little over 79,000,000 cubic feet, and the amount they received for residual products was £4441, which was at the rate of £56 2s. per million cubic feet. The consumption last year was about 94,500,000 cubic feet; and had they realized the same rate per million cubic feet as in 1884, they would have had £5300 instead of £3477, which they did receive, or £1823 more. The amount paid for labour was from 40 to 45 per cent. more than it was three years ago; and, so long as the present rate of wages was maintained by gas-works throughout the country, he did not think there could be any reduction at Tipton. Taking into consideration these facts, he did not think the Board would be surprised that the Committee were forced to raise the price of gas by 3d. per 1000 cubic feet. The only wonder seemed to him that the advance was so little; and had it not been for the great saving effected by improved appliances, and by the excellent management of their Engineer (Mr. V. Hughes), a larger increase would doubtless have been imperative. They looked forward to the time when residuals would rise in value, and when the Committee would be able to reduce the price to its former low level. The charge to large consumers was now 2s. 3d.; and they proposed to increase it to 2s. 6d.—the others being in proportion. On comparison, he thought it would be found to be lower than the average throughout the country. The accounts were passed.

MANCHESTER CORPORATION GAS AND WATER SUPPLY.

The Gas Committee and Tender Letting—The Water-Works Sinking Funds—A Short Supply of Water.

At last Wednesday's Meeting of the Manchester City Council, Mr. J. Brooks, Chairman of the Gas Committee, alluded to a report which had been presented to the Council on the subject of the tenders for the erection of a new gasholder at the Bradford Road works. It will be remembered that this question was under discussion at the previous meeting, when it appeared that a tender submitted by Mr. J. Nuttall for £30,897 8s. had been accepted by the Committee in preference to one (which was £1982 6s. 8d. less) sent in by another competent firm, Messrs. J. Wilson and Co. Some members raised strong objections to this; and the matter was then referred back to the Committee (see *ante*, p. 837). Mr. Brooks now stated that the only object the Committee had had in selecting the tender of Mr. Nuttall was to get the work completed at the earliest date. It was intended to have the holder ready for the winter of 1894-5; and Mr. Nuttall's was the only tender which gave the possibility of that being accomplished. This was the important factor in the decision of the Committee to recommend the Council to accept the tender; and he moved the adoption of the Committee's proceedings. The motion having been seconded, Mr. Hampson said he did not accept the extreme urgency of the case as presented by the Chairman. The report did not tell them that they had only recently constructed a new holder at Droylsden, and that they would shortly have another at Gaythorn, to say nothing of the electric light, which, he understood, would be supplied by August. It seemed to him that the urgency spoken of was not of sufficient importance to warrant the acceptance of a tender nearly £2000 above that of another firm. It appeared to him to be a wilful waste of money; and he proposed, as an amendment, that the contract be not let for the present. This was also seconded. In answer to a question, Mr. Brooks said he had seen Messrs. Wilson, and they would not undertake to complete the holder before Dec. 31, 1894; while Mr. Nuttall would have it finished by May 31, 1894. Mr. Fildes took exception to the paragraph in the Committee's report in which they said that they could not be held in any way responsible for the delay which had taken place in the letting of the contract, "which might have a most serious effect on the future supply of gas, and cause inconvenience and loss to the consumers and loss of revenue to the Gas Committee." It was hardly fair that the Committee should place the responsibility upon the Council. It appeared that the Committee took six months before they received the contracts for the holder; and they did not take that into consideration. He asked that that portion of the report should be expunged. Mr. Bagnall urged that it was in the interest of the Committee and of the ratepayers that the contract should be given to Mr. Nuttall. The electric light had nothing to do with the consumption of gas, because experience showed that, wherever the electric light had been introduced, the consumption of gas had increased. Sir J. Harwood pointed out that the amendment merely involved a waste of time. If Mr. Hampson would move that the next tender to that of Mr. Nuttall be accepted, that would settle something. Mr. Hampson accordingly moved that the tender of Messrs. Wilson, who contracted to do the work for £28,915, be accepted; and Mr. Wilson seconded the amendment. After further discussion, Mr. Brooks replied, pointing out that the holder at Gaythorn would only contain 1,500,000 cubic feet of gas, and that the Droylsden holder was for local use entirely. On a division, 11 voted for the amendment, and 42 for the motion, which was therefore adopted.

At another stage of the proceedings, a letter was read from the Local Government Board formally approving of suggestions of the Finance Committee with regard to the mode of dealing with certain sinking funds—chiefly those of the Water and Improvement Committees. A short statement was made by Sir J. Harwood as to the manner in which the Water Committee were affected by the arrangement. He said they had succeeded in getting the Government to relieve them in the matter of the sinking fund. It meant a reduction of £18,000 a year; and this would enable them, if they continued to increase in the sale of water at the same rate during the next five years as during the past five years, to bring the Thirlmere water to Manchester—10 million gallons per day, the tunnels, watercourses, and embankments being cut for 50 million gallons—without raising the rates by a single penny. This was a result which everybody would be gratified to hear. The matter had cost them a great amount of anxiety and trouble. When they went to London about it, they asked if they could not be relieved in some other channels; and the President of the Local Government Board very graciously entered into all their suggestions, and had relieved the rates by postponing the payments in a gratifying and satisfactory way. If they had had to increase the water-rate, it would have been to the extent of 5d. on the domestic rate; but the Council might take it that there would be no increase in the charge. Sir John also mentioned, in the course of the meeting, that the Committee had then only 72 days' supply of water in stock, which was very much less than last month. Unless rain came within a few days, something, he said, would have to be done to curtail the supply.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Aberdeen Town Council on Monday adopted a resolution, with reference to the management of their electric lighting installation, which has considerable significance. The subject came up on a recommendation by the Gas Committee to appoint an Engineer for the installation, at a salary of £200, to be directly responsible to the Council itself. This resolution was opposed; and, after discussion, the Council resolved that the Engineer should be subordinate to Mr. A. Smith, the Gas Manager. The argument in support of the Committee's recommendation was that the man who was capable of carrying on the electrical engineering department should not be under one who, however much he might know about gas, had no special knowledge of electrical engineering. The view set forth on the other side was that, if the Gas Manager were not able to superintend the electric lighting department, the Gas Committee should not be entrusted with it, but a new Committee should be created; and that Mr. Smith had hitherto carried on the arrangements for the electric lighting most heartily and successfully, and was quite competent to superintend the electrical department. As between the two arguments, I consider that the Council arrived at the right conclusion. An electrical engineer at £200 a year would not be a very valuable acquisition to the municipal staff; whereas Mr. Smith, who is an old and tried and trustworthy servant of the Corporation, and who has in reality piloted them through the initial stages of the movement, is quite capable of looking after all the electric lighting business the Corporation are likely to have for years to come.

Mr. Smith, recently reported to his Committee with reference to the enrichment of their gas with oil. He stated that he thought it would be well, before he proceeded to alter the old retort-bench into one on the regenerative system, as sanctioned in September last, that he should be authorized to visit several of the gas-works where oil gas is made, and ascertain the facts connected with the process by inspecting the apparatus in action. The Committee recommended the Town Council to send Mr. Smith and the Convener (Mr. Farquhar) on a deputation, to collect information and to report. The recommendation came before the Council on Monday, and was adopted.

The rather hot warfare which has been waged for some time between the Falkirk Gas Company and the Police Commissioners, regarding the charge for gas supplied to the public lamps, has been settled by compromise. The Police Commissioners declined to pay an account for £415; and alleged that an overcharge was being made. The reply of the Gas Company was that they went by the readings of the metered lamps; and that there must be leakage in the fittings of the lamps, the care of which was in the hands of the Police Commissioners. By the compromise which has been effected, the Police Commissioners agree to pay the account of the Gas Company under deduction of £40; and the Company are to undertake the repair and maintenance of the lamp-fittings. At the Commissioners' meeting on Monday, gratification was expressed that an amicable settlement had been arrived at.

A deputation from the Perth Gas Commission have visited Peebles, to see Mr. Young's oil-gas plant at work, and have reported favourably as to its adoption. The process, it is calculated, would save the Commissioners about £1200 a year, and would enable them to raise the illuminating power of the gas from 27 to 30 candles. At present the Commissioners pay £250 a year for the cartage of shale; and they expect that sum to be doubled very soon, when they require to cart their refuse farther away than at present—the place of deposit being nearly filled up. They also believe they would be able to save largely upon the cost of breaking coal, and in fuel.

The question of the liability of the owner of a house for providing proper gas-pipes was tried before the Dundee Sheriff Court this week. A landlord sued his tenant for a sum of £7 2s. 9d. of rent for the half year, against which the tenant claimed to deduct £1 10s. 4d., as the amount of charge for gas during the half year, which was imposed by the Gas Commissioners above the charge for the corresponding period of last year. In support of the counter-claim, it was stated that a slater who was repairing the roof found that a gas-pipe was leaking, and that an escape of gas had been going on for some time. The Sheriff said that, while no blame could be attached to the landlord, yet, when he supplied gas-pipes in a house, he undertook that they should be fit to carry gas; and he allowed the tenant a deduction of 12s. from the rent, with part expenses.

Lord-Advocate Balfour has given an opinion with regard to the liability of local authorities for damage to gas-pipes by road-rollers, which it is the interest of gas companies to know, in these days of increased weight in road rolling. His Lordship holds clearly that local authorities are liable. This opinion was promulgated at a meeting of the Dunfermline District Commissioners of the Fife County Council this week, in connection with a claim by the Kincardine Gas Company for £10 6s. 8d. in respect of damage to their pipes. The Committee, however, resolved to deny liability; so that it now only remains, in order to make the Lord Advocate's opinion authoritative, that it shall be enforced in the Law Courts.

Messrs. R. and J. Dempster, of Newton Heath, have secured the contract for the construction of a new gasholder for the Irvine Gas Company, at a cost of £9197.

Professor A. B. W. Kennedy has been appointed Engineer to the Edinburgh Corporation in connection with their proposed electric lighting installation. This means that the Corporation will adopt the three-wire low-tension system, and pay royalty to Dr. Hopkinson.

Mr. A. B. Brown, of Messrs. King, Brown, and Co., Rosebank Iron-Works, Edinburgh, who are, I think, the only firm in the Edinburgh district which is practically engaged in the electric lighting business, publishes in the *Scotsman* this week a very sensible letter, in which he advises that the electric lighting installation of the Corporation should be served by gas-engines. Mr. Brown knows thoroughly the subject on which he writes; and he is aware of the weakness of existing arrangements, under which the same gas is made to do duty for both illuminating and power purposes. His proposal is that the Corporation should establish the gas-engine in the production of electricity; but he does not advise that they should use the gas which is supplied to the citizens as an illuminant. He proposes that they should establish plant in the most central part of their area, which would be served by a gas-engine using what he describes as gas made from the coke obtained at the gas-works, and which is in reality, though he does not say so, water gas. He states that at present a Scottish firm is constructing a compound gas-engine of 600 indicated horse power, which is to take the place of one of the most economical steam-engines recently put into a mill; and that his firm are about to supersede a 200-horse power steam-engine, consuming about 5 lbs. of unscreened coal per horse power per hour, costing 6s. per ton, by a compound gas-engine of similar power consuming 1½ lbs. of coke, costing 4s. per ton. He is convinced that the steam-engine will, for stationary purposes, be swept away in a few years, and that the gas-engine will take its place. This is the opinion of one who is an expert on the subject; and though it may not be possible to subscribe to all he says, in view of the many-sided nature of the subject, there is no doubt that, so far as Edinburgh is concerned, he is on the right tack. Even in that city, there have been observations made, with reference to electric lighting plant, which would condemn an extensive adoption of the ordinary steam-engine for the production of electricity. I shall not enter into the subject as it relates to private installations, because they are all ruled by one, which is public. That is the Public Library. The electric light has been introduced there; and, however the matter may be as to £ *s. d.*, there is every night a dense volume of black smoke emitted from the chimney of the works which supply the electricity. A system of gaseous fuel would obviate that. Whether it would be cheaper is another matter; but that is of less moment than would be the purification of the air of large towns. So far I go along with Mr. Brown; but when he advocates that the gas he recommends (water gas) would be suitable for gas-cookers, I part company with him. Such a gas would be highly dangerous for use, indiscriminately, in private houses, because of its poisonous qualities. It is a question, however, for gas-supplying bodies, in places where a great deal of power is required, whether they should not lay down plant and mains to supply power, by means of water gas, within a restricted area, leaving the supply of gas for cooking and heating purposes to be derived from the same safe source as the illuminating gas. There are many *pros* and *cons* of the subject, which cannot be dealt with in one of these "Notes;" but so far as the providing of electric light in such a scattered area as that in Edinburgh is concerned, there is certainly no better proposal than that it should be by gas-engines, with water gas as the power producer.

In places which depend upon gathering-grounds for their water supply, the local authorities are beginning to look anxious. It would be a very severe drought indeed which would affect the water supply of Glasgow, Dundee, Aberdeen, or Perth; but it is otherwise with the Edinburgh and Leith district, where the supply is taken from the surplus which is gathered upon hill countries. It can hardly be said that alarm has yet set in; but the Water Trustees are commencing to look serious over the matter. They have in store only a supply which will carry them to the beginning of September; and after that, if the storeage reservoirs fail, they will have to fall back upon the springs in the Pentland Hills. These, too, as compared with what they were in the middle of May, 1870, are this year yielding 10,000 gallons per day less; and if the drought continues, the yield will doubtless go still further down. In 1870 the supply in September was at the rate of only 7½ gallons per head of the population per day, which compares very badly with the 38 to 40 gallons which are usually supplied. Of course, there is abundance of time in which sufficient rain may fall to avert a water famine; but the Trustees cannot rely upon relief in that way, and hence their anxiety, which is well founded. This brings to the front very sharply the question of procuring an additional water supply—a subject upon which there has been a good deal of heartburning for some years. A section of the Trustees have been endeavouring to educate their brethren and the community upon the necessity for at once proceeding to augment the supply; but they have been opposed by parties who, it is supposed, having supported the Moorfoot scheme and carried it as against the St. Mary's Loch scheme, after the drought in 1870, do not like to acknowledge that they were then in the wrong when they held out that the Moorfoot Hills would provide a sufficient supply for many years to come. The result has been that the Trustees have put off doing anything more than tentatively. Now, however, it is stated, some of their number who were influenced by the outside opposition, having seen how the reservoirs are going down, have thrown in their lot with the section who wish an augmentation scheme; and it is likely that a Bill will be lodged in Parliament next session to have it carried out. The augmentation section, as is well known, have been looking again to St. Mary's Loch, and to the Manor Water and the upper tributaries of the Tweed, or what is known as the Talla Water, for the further supply. Having brought in the Moorfoot scheme, it is felt that it is not so necessary to provide an inexhaustible supply; and St. Mary's Loch is not at this time in favour. The scheme which is preferred is that of the Manor—a beautifully clear stream, which falls into the Tweed above Peebles. The Trustees have been boring in the Talla Valley, with a view to ascertaining what the cost would be of constructing a large gathering reservoir there. That work has now been completed; and the Works Committee had the subject under consideration yesterday. Messrs. Leslie and Reid, the Engineers to the Trust, reported that they estimated the cost of the Manor scheme would be £65,236 per million gallons, and of the Talla scheme, £78,333 per million gallons; and that they strongly recommended the adoption of the Manor scheme. The Committee did not arrive at any resolution on the subject, but adjourned till next week.

The accounts of the Dundee Water Commission for the past year, it is reported, though they have not yet been fully balanced, show a deficit of about £300. The estimated expenditure of £46,500 has not been exceeded; but the estimated revenue of £46,564 has not been reached. There has been a falling off to the extent of over £600 in the revenue derived from water supplied by meter, due to the fact that for six months the mills and factories in the city ran short time. There is, however, an increase of about £300 in the revenue from other supplies, which leaves the deficit of £300. It is expected that the rates wil be fixed the same as last year.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June* 10.

Sulphate of Ammonia.—The market continues strong; and such is the scarcity of spot parcels that orders can only be filled with difficulty. This position on the eve of the smallest production of the year may provoke startling results if the demand keeps up to the present level. Liverpool and London, probably, as being best situated for the orders at present in the market, receive the largest share of buyers' attention; and prices are up quite 5s. per ton. Hull and Leith, on the other hand, are practically unchanged; but even at these ports there is very little offering. Liverpool is now quoted at £12 10s.; and Leith and Hull, at £12 5s. Nitrate is again lower (8s. 6d. for ordinary quality); and although arguments are plentiful as to the ultimate effect of this low price upon sulphate values, it is quite certain that, for the present and probably for some time to come, sulphate will not budge much, whatever nitrate may fall to.

LONDON, *June* 10.

Tar Products.—The enormous flood of benzols from German coke-ovens, which has swamped the market, has compelled the carbonizing works in this country, with one or two exceptions, to cease working. Although this has been known for some weeks, it has had no influence on the values of benzols, which to-day are as stagnant as they well can be, and the prices named below are nominal; little or no genuine business being possible at the moment. The other products are also dull; and, notwithstanding the exceptionally hot weather, carbolic disinfectants have fallen in value. Pitch is a shade weaker; but there appear to be buyers at slightly lower prices than those here quoted. Large quantities of tar oils and naphthalene are being burnt for fuel to relieve stocks. This is somewhat remarkable, having regard to the period of the year. Values may be taken as follows: Tar, 12s. Pitch, 23s. to 24s. Benzols, 90's, 1s. 6d.; 50's, 1s. 5d. Solvent naphtha, 1s. Toluol, 1s. 4d. Crude benzol naphtha, 30 per cent., 7d. Creosote, 1d. Salts, 17s. Carbolic acid, 60's, 2s.; 70's, 2s. 4½d.; crystals, 7d. Cresol, 1s. 9d. Anthracene, nominal, 30 per cent. "A," 1s.; "B," 8d.

Sulphate of Ammonia.—There is a capital market for this article; and although nitrate is somewhat weaker, so far the value of sulphate has not responded to the lower price mentioned for nitrate. On the contrary, business is reported at a distinct advance of 5s. during the week; while for forward delivery business is possible at about £12 per ton. Business done during the week has been at prices ranging between £12 and £12 5s. per ton, less 3½ per cent. Gas liquor, 10-oz., is quoted at 7s. 6d. to 8s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—During the last week or so, one or two important gas coal contracts have been settled—the principal being that for Liverpool; and it is understood that the supply of Lancashire gas coal in this case has been secured entirely by one large Wigan colliery company. The prices at which this contract has been settled have not transpired; but considering the keen competition that is going on in the gas coal trade, it may be taken that there has been a very substantial concession upon the prices ruling last year. So far as any definite information can be gathered with regard to the basis on which gas coal contracts have been settled, they represent a reduction of quite 1s. per ton upon the prices which the gas companies had to pay last season; and that this is the case is borne out by the fact that, as a rule, where tenders that have been sent in have not been based on a reduction to this extent they have been unsuccessful. In some cases sellers have been even prepared to come 1s. 6d. below last year's figures. The full average pit price for common screened Wigan gas coal seems to be about 7s. 3d. up to 7s. 6d.; and for the best Wigan gas coals, about 8s. 3d. up to 8s. 9d. per ton at the pit mouth. With regard to other descriptions of round coal, there is no change to report. All classes are quite as difficult to move as ever; and, if anything, pits are gradually getting on to less time—very few of them working more than from three to four days per week. At the pit mouth, best Wigan Arley coals do not average more than 11s. to 11s. 6d.; Pemberton four-feet and second qualities of Arley, 9s. 3d. to 9s. 9d.; with common round coal ranging from 6s. 3d. to 6s. 6d. per ton, for steam and manufacturing purposes. The very limited production of slack is causing a continued hardening in engine fuel; and outside buyers have in most cases to pay advanced prices to secure supplies. At the pit mouth, burgy ranges from 6s. 3d. to 6s. 9d.; best slack, 5s. 3d. to 5s. 9d.; and medium, 4s. to 4s. 6d. per ton. The shipping trade remains without improvement; and steam coal is only in exceptional cases fetching more than 7s. 6d. to 7s. 9d., delivered at the Garston Docks or the High Level, Liverpool.

Northern Coal Trade.—The condition of the Northern coal trade is rather languid just now; but there is a fair demand for best steam coal, and the collieries that produce it have tolerably full work. Best Northumbrian steam coal is quoted at 8s. 7½d.; second qualities, 8s.; and small steam coal, 3s. 6d. per ton f.o.b. There have been allotted during the past few days the chief locomotive coal contracts for the North-Eastern Railway for the next six months; and the price is found to be generally 6d. to 9d. per ton less than that which has been paid under the contracts now expiring. Manufacturing coal is quiet; but the consumption seems to increase slightly. For gas coal, for inland use, the consumption is now very low; but there is a satisfactory export of this class of coal, both from the Tyne and from Sunderland. Best Durham gas coal is quoted generally from 6s. to 6s. 6d. per ton f.o.b.; but one or two collieries which are exceptionally situated as to contracts they hold still ask 7s. For coke, with an increased demand there is a rather improved price; and from 13s. 6d. to 14s. per ton f.o.b. is the quotation for best foundry kinds. There is no alteration in the price of gas coke; but the production is now very small, and stocks are more limited than they were a few weeks ago.

Scotch Coal Trade.—Scotch coalmasters are either in a "pickle" or are playing an astute game; and time only can tell whether it is to be successful or not. A year ago, when the Durham strike was in progress, orders for coal came thick and fast to Scotland. Now the North of England coalmasters are doing their utmost, and with a considerable degree of success, to get back the trade they then lost. The miner is the unstable quantity, who is either forging a policy of his own, or is being made the tool of his master. The miner is restricting his output to the extent of about 100,000 tons per week; and coalmasters are clearing off the stocks they had on hand. The miner expects by this policy to raise his wages; and meanwhile the coalmaster is quiescent—almost encouraging that policy. Whether the result will be to raise the men's wages, or to place the masters in a fix when they find their stocks exhausted, is the problem which is being worked out. Whenever the stocks get down so far, it may be taken for certain that the miners will demand higher pay; and the question is whether the masters will then be able to afford it. Of course, there remains the question of whether, in the event of the men demanding, and the masters refusing, an increase of wages, the men could enforce their demand by means of a strike. Everything points to the probability of their not being able to do so, and to the masters acting wisely in getting quit of their present stocks, procured at proportionally higher wages than are paid now, and then having the miners at their mercy when the market regains its normal condition of supply and demand. The miners at present have no money wherewith to strike; and it would be folly for them to attempt it. The masters could stand a week or two of strike, if it would improve their position; but then they have to face the fact that a strike in Scotland would drive a large proportion of their trade elsewhere. It is there that the problem comes in, which time only can solve. Meantime, what changes in price are reported are on the rising side. The quotations are: Main, 5s. 9d.; ell, 6s. 9d. to 7s.; splint, 6s. 3d. to 6s. 5d.; and steam, 7s. 9d. to 8s. per ton f.o.b. Glasgow. The shipments for the past week were 154,674 tons—an increase as compared with the previous week of 12,032 tons, but a decrease as compared with the corresponding week of last year of 37,105 tons. For the year to date, the total shipments have been 2,679,192 tons—a decrease as compared with the same period of last year of 349,923 tons.

Lancaster Corporation Water Department.—It was reported at the last monthly meeting of the Lancaster Town Council that the working of the Water Department had resulted in a net balance of £3493, of which it had been decided that £1993 should be paid to the renewal fund, and £1500 be transferred to the borough fund.

The Proceedings against the South Metropolitan Gas Company for Nuisance.—In the Chancery Division of the High Court of Justice, last Saturday, Mr. Justice North had before him the case of *Wellby v. South Metropolitan Gas Company*. It was an action brought by the daughter-in-law of Mrs. Chapman—the plaintiff in the case recently tried by Mr. Justice A. L. Smith (see *ante*, pp. 359, 415, and 460)—in respect of adjoining property. It was stated by Counsel that the present case was on the same lines as the other, and that consequently there was nothing to be decided. Under the circumstances, it had been arranged that an order similar to the one in Mrs. Chapman's action should be made in this case, but without prejudice to the right of the defendants to have it set aside in the event of their being successful in an appeal from the decision of Mr. Justice Smith. His Lordship made an order in the terms agreed upon.

Failure to Supply Compensation Water.—At Mold, on the 30th ult., a case was heard in which the Alyn Steel Tin-Plate Company were the plaintiffs and the Hawarden District Water Company the defendants. Mr. G. H. Bradley prosecuted; Mr. E. H. Lloyd defended. Some years ago the Company obtained the permission of Parliament to construct at Cilcain a reservoir capable of containing 62,500,000 gallons of water, on condition that, on the completion of the works within a certain time, 250,000 gallons of compensation water should be supplied daily. The plaintiffs claimed a penalty against the defendants for failing to do this, and also for neglecting to erect gauges sufficient for regulating the delivery of the water. Mr. Lloyd contended that, as the works had not been completed, his clients were under no liability to supply compensation water. Mr. Scott Bankes (Chairman of the Bench) said he was in favour of granting a case, as it was a difficult thing off-hand to interpret an Act of Parliament. The majority of the Magistrates, however, were for inflicting a nominal penalty of £2. A case was granted; and Mr. Bradley was allowed costs, on condition that the decision was not reversed by a higher Court.

Exhibitions of Gas Appliances.—Exhibitions of gas appliances were held at Bath, Bolton, and Dulwich last week, by the Davis Gas-Stove Company, Limited; Miss Ellen Johnston, Mrs. Springthorpe, and Miss Ida Cameron giving lectures on cookery at the respective places. On Monday of last week, the Mayor of West Bromwich opened an exhibition of gas appliances in the Town Hall. The bulk of the exhibits were supplied by Messrs. Parkinson and Co., whose business in this department has made steady progress, and is now permanently established; and Wingfields, Limited, contributed some choice specimens of brass and other metal work as applied to chandeliers and gas-fittings. Prominent among the lighting appliances was the new "Vertmarche" regenerative gas-lamp of Messrs. H. Greene and Sons. The great feature of the exhibition (which was continued to Friday) was the series of cookery demonstrations conducted by Miss Thwaites, of the Liverpool School of Cookery. During the past fortnight, an important exhibition of gas appliances has been held in the St. James's Hall, Manchester, by Messrs. Richmond and Co., Limited. Here, too, the "Vertmarche" lamp was on view. Lectures on cookery were given twice daily by Miss Owen. Messrs. Richmond and Co. have also been exhibiting very successfully in Dundee. During the past week, Messrs. J. Wright and Co. exhibited a large number of their various gas stoves and appliances in the hall of the Alliance and Dublin Consumers' Gas Company; and, in conjunction therewith, Miss H. J. K. Grieve gave a course of lectures on the advantages of cooking by gas. They are also holding an exhibition in the Albert Hall, Edinburgh, with cookery demonstrations twice daily by Mrs. J. B. Thwaites. Under the auspices of the West Kent Gas Company, Messrs. Fletcher, Russell, and Co. last week held an exhibition at Erith, with Mrs. Wilkinson to give the cookery lectures and demonstrations.

The Use of the Divining-Rod in Searching for Water.—Mr. J. Blanchard, a "diviner," was recently engaged by the Withnell Local Board to use his powers, assisted by a hazel twig, in tracing water. He fixed upon certain spots where boring operations will be commenced. Experiments have also been conducted at Samlesbury and Longridge.

The Proposed Reduction in the Quality of the Leeds Gas.—Reference was made in the JOURNAL a fortnight ago to the proposal to reduce the quality of the gas in Leeds. On the 30th ult., the Gas Committee had under consideration the results of the experiments which have been in progress for some months past with the object of effecting a saving in the use of cannel; and they decided to recommend that the illuminating power should be fixed at 18 candles. At the same time, it was considered expedient, in view of the necessity of never allowing the standard to fall below this figure, to recommend the issue of instructions to the Managers of the various stations to aim at keeping the quality up to 18½ candles.

St. Helens Corporation Gas Affairs.—At the meeting of the St. Helens Corporation Gas Committee on the 31st ult., it was reported that the profits on the gas supply for the past year amounted to nearly £2900. The Committee had decided to reduce the price of gas 1d. per 1000 cubic feet to ordinary consumers; while the cost to prepayment meter consumers would be reduced from 4d. to 3½d. per 100 cubic feet. To show the increase in the consumption of gas, it may be stated that the quantity made in 1887 was 166 million cubic feet, while last year it was 214 millions. It was agreed that the salary of the Engineer (Mr. S. Glover) should be advanced £100; and afterwards it was resolved to recommend the Council to adopt the Young oil-gas making system—instructions being given for the preparation of plans.

Salisbury Gas Company.—At an extraordinary meeting of this Company held on the 24th ult., the Chairman (Mr. G. Fullford) moved a resolution that the shareholders should empower the Directors to raise, in conformity with their Act of Parliament and a Provisional Order of the Board of Trade, a sum of £6000 by the issue of £12 10s. shares. He explained at length the necessity existing for the erection of a gasholder of at least 400,000 cubic feet capacity, to meet the cost of which the present capital was required. Mr. S. Griffin seconded the motion, and it was carried unanimously. Mr. S. R. Atkins moved, and Mr. W. Young seconded, that, at a date to be fixed by the Directors, such part of the £6000 authorized as might be necessary should be submitted for sale by public auction. This was also agreed to. The plans and specifications for the new works to be carried out have been prepared by Mr. T. Hardick and Mr. Norton H. Humphrys.

New Joint Stock Companies.—The following joint-stock undertakings have lately been registered: Buckfastleigh Gas Company, Limited, with a capital of £5000, in £5 shares, to manufacture and supply gas at Buckfastleigh, Devon. Crosshills Water Company, Limited, with a capital of £4000, in £5 shares, to acquire and carry on the business of the Company supplying Crosshills, in Yorkshire, with water. The firm of Clapham Brothers, of Keighley, Yorks., which was established in 1837, and continued without any change in the *personnel* from that date until December last, when the elder brother (Mr. J. Clapham) retired from the business, has been converted into a private limited company, with a capital of £40,000, in £10 shares. The first Directors are the remaining members of the old firm—Mr. Thomas Clapham and Mr. William Clapham—who are life Directors, and their sons, Mr. T. S. Clapham and Mr. S. B. Clapham, both of whom have taken an active part in the management of the business for many years.

The Pollution of Wells by the Burton-on-Trent Gas-Works.—At the meeting of the Burton-on-Trent Town Council last Wednesday, the Gas Committee presented a report which was specially interesting from the fact that it contained a recommendation for the settlement of a claim made by Messrs. Allsopp and Sons for compensation for the pollution of their well by the Corporation Gas-works. The Committee stated that they had ascertained that the Company would accept £2000 and the costs in the action in full discharge of their claim; and they "therefore, under the circumstances, advised that the action be settled on those terms." In moving the adoption of the report, Alderman Lowe remarked that some time ago he stated to the Council how far they had advanced in their negotiations with the firm, the amount of the claim, and what was looming in the distance. It would be remembered that on Dec. 15, 1890, they received a claim from Messrs. Allsopp and Sons on account of the alleged contamination of their water by the gas-works; and they requested as compensation £9075. This demand fairly took away their breath; and the Committee did not feel, even if they were liable, that they could listen to it. They thought that, if they were to blame, they could at least get off with a much smaller sum. They at once instructed their Manager (Mr. F. L. Ramsden) to investigate the matter; and he took water, and submitted it to Messrs. Matthews and Lott for analysis. Samples were drawn from 22 different borings, and analyzed; and the Committee, as well as the analysts, were clearly of opinion that there had been contamination. Whether this had arisen through the percolation from the gas-works, or, as some people had said, through gas tar being used, they could not say. They dealt with the facts as they were; and every member of the Committee, he was bound to say, was satisfied that the work done by the Town Commissioners a great many years ago had caused the percolation (if injury had thus been produced) and the damage sustained. Believing, however, that they were liable, the Committee felt they ought to settle the matter on the best terms possible. Proceeding upon the lines of an arrangement come to with Messrs. Bass and Co., the Committee offered Messrs. Allsopp £200 or £300; but this was declined. They next offered £1000, and subsequently £1500. After some negotiation, Messrs. Allsopp expressed their willingness to take £2000. He was not going to advocate in any strong terms the acceptance by the Council of this offer; but he would like to point out that if the Council, in their wisdom, declined to agree to it, the responsibility of such action was theirs, and not the Committee's. His own opinion was that the Corporation were legally liable; as to the moral liability, he would say nothing about it. Mr. Turner seconded the motion, which, after some discussion, was carried.

The Burnley Corporation Gas Undertaking.—The gas-works of the Burnley Corporation have during the past year made a profit of only £828; the estimated amount in last year's estimates being £6600. The decrease is mainly due to the fact that for several months the mills in the town were running short time or closed entirely, owing to the Oldham strike; the estimated loss under this head being put down at £3500. There is also a falling off in the receipts for residuals; while wages and the cost of production have remained about the same.

Milton and Sittingbourne Water Supply.—A special meeting of the Sittingbourne Local Board was held on the 30th ult, for the purpose of considering the question of enlarging the local water-works; the Milton Town Commissioners, as already mentioned in the JOURNAL, having resolved to join in the scheme, instead of going in for separate works. The Surveyor presented a report in which he advocated that the works should be duplicated in their entirety; and that the new works, which he estimated would cost about £4000, should be located nearer to the town than the present ones, which are two miles off. A Committee of the whole Board was appointed to consider details.

The Dispute over the Laying of a Water-Main at Chesterfield.—At a special sitting of the Justices of the Peace at Chesterfield on the 2nd inst, the dispute which has been some time in progress between the Chesterfield Corporation and the Gas and Water Company, with respect to a supply of water to the lodge in Queen's Park (to which reference has previously been made in these columns) was finally decided. It was contended by the Town Clerk, on behalf of the Corporation, that they had fully complied with the law as to the giving of fourteen days' notice before commencing to lay a pipe, &c.; and all that the Corporation had taken proceedings for was to obtain a decision from the Justices as to the manner in which the pipe should be connected. Mr. Ellison, who appeared for the Company, asserted that proper notice had not been given; and Mr. C. E. Jones, their Engineer and Manager, denied that the plumber who gave the notice purported to act as the agent of the Corporation. The Court decided that the proper fourteen days' notice had not been given; and they, therefore, declined to make an order.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1094.)

Issue.	Share	When ex-Dividend.	Dividend or Div. as Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Apl.	10½	Alliance & Dublin 10 p. c.	10	17–18	..	5 16 8
100,000	10	,,	7½	Do. 7 p. c	10	12–13	..	5 15 5
300,000	100	3 Jan.	5	Australian (Sydney) 5 % Deb.	100	104–106	..	4 14 2
100,000	20	31 May	8	Bahia, Limited	20	10½–11½*	..	13 18 3
200,000	5	12 May	6½	Bombay, Limited	5	5½–6	..	5 8 4
40,000	5	,,	6½	Do. New	4	3¾–4¼	..	6 2 6
380,000	Stck.	24 Feb.	11½	Brentford Consolidated	100	217–222	..	5 3 7
180,000	,,	,,	8½	Do. New	100	168–173	..	4 18 3
220,000	20	15 Mar.	11½	Brighton & Hove Original	20	41–43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	104–107	..	4 13 5
320,000	20	13 Apl.	11½	British	20	42–44	..	5 4 7
50,000	10	15 Mar.	11½	Bromley, Ordinary 10 p. c.	10	19–20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	14½–15½	..	5 9 8
328,750	10	—	—	Buenos Ayres (New) Limited	10	6–7	+½	—
200,000	100	3 Jan.	6	Do. 6 p. c. Deb.	100	98–102	+1½	5 17 8
150,000	20	24 Feb.	8	Cagliari, Limited	20	25–27	..	5 18 6
550,000	Stck.	28 Apl.	12½	Commercial, Old Stock	100	244–249	+1	5 0 5
165,000	,,	,,	9½	Do. New do.	100	182–187	..	5 1 7
160,762	,,	15 Dec.	4½	Do. 4½ p. c. Deb. do.	100	127–132	..	3 8 2
800,000	Stck.	15 Dec.	13	Continental Union, Limited	100	230–235	..	5 10 8
200,000	,,	,,	10	Do. 7 p. c. Pref	100	192–197	..	5 1 6
75,000	Stck.	15 Mar.	10	Crystal Palace District	100	187–194	..	5 4 2
486,090	10	27 Jan.	10	European, Limited	10	21½–22½	..	4 8 11
354,060	10	,,	10	Do. Partly paid	7½	15–16	..	4 13 9
5,596,560	Stck.	10 Feb.	12	Gaslight & Coke, A, Ordinary	100	218–223	+3	5 7 7
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	95–99	..	4 0 10
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	263–268	..	3 14 7
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	120–125	..	4 0 0
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	170–175	..	4 5 8
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	169–174	..	4 0 5
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	262–267	+2	3 14 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	156–160	..	3 15 0
1,061,150	,,	15 Dec.	4	Do. 4 p. c. Deb. Stk.	100	124–128	..	3 2 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	130–134	..	3 7 2
908,000	,,	,,	6	Do. 6 p. c. do	100	169–173	..	3 9 4
3,800,000	Stck.	12 May	12	Imperial Continental	100	218–223	+1½	5 7 7
75,000	5	30 Nov.	6	Malta & Mediterranean, Ltd.	5	5–5¼	..	5 9 1
560,000	100	4 Apl.	5	Met. of Melbourne, 5p. c. Deb.	100	103–105	..	4 15 3
541,920	20	16 Nov.	5	Monte Video, Limited	20	13¾–14¾	..	6 18 0
150,000	5	31 May	10	Oriental, Limited	5	7¾–8*	..	6 5 0
60,000	5	29 Mar.	7	Ottoman, Limited	5	4½–4¾	..	7 3 8
166,870	10	—	2	Pará Limited	10	1¾–2¼	..	—
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	100–105	..	5 14 3
500,000	100	1 June	6	2nd Do.	100	98–102*	..	5 17 8
150,000	10	28 Apl.	5	San Paulo, Limited	10	8–8½	..	5 17 8
500,000	Stck.	24 Feb.	15½	South Metropolitan, A Stock	100	294–299	..	5 3 8
1,350,000	,,	,,	12	Do. B do.	100	244–248	..	4 16 9
230,000	,,	,,	13	Do. C do.	100	250–255	+2½	5 1 11
750,000	,,	13 Jan.	5	Do. 5 p. c. Deb. Stk.	100	148–152	..	3 5 9
60,000	Stck.	15 Mar.	11½	Tottenham & Edm'nton, "A"	100	225–230	..	5 0 0
				WATER COMPANIES.				
744,897	Stck.	30 Dec.	10	Chelsea, Ordinary	100	262–267	–1	3 14 11
1,720,252	Stck.	29 Mar.	8	East London, Ordinary	100	207–212	–1	3 15 4
544,440	,,	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	142–145	..	3 2 1
700,000	50	15 Dec.	8½	Grand Junction	50	108–112	–1½	3 15 10
708,000	Stck.	10 Feb.	11	Kent	100	278–283	–2	3 17 9
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	237–242	–3	3 18 6
406,200	100	,,	7½	Do. 7½ p. c. max.	100	199–204	..	3 14 0
310,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	129–132	..	3 0 7
500,000	100	10 Feb.	12½	New River, New Shares	100	329–334	..	3 12 8
1,000,000	Stck.	27 Jan.	4	Do. 4 p. c. Deb. Stk	100	133–137	..	2 18 5
902,300	Stck.	15 Dec.	6†	S'thwk & V'xhall, 10 p. c. max.	100	147–152	–11	3 18 10
126,500	100	,,	6†	Do. D 7½ p. c. do.	100	143–148	–2	4 1 1
1,155,066	Stck.	15 Dec.	10	West Middlesex	100	257–262	..	3 16 3

*Ex Div.

† Next dividend will be at this rate.

Reduction in the Price of Gas at Truro.—The Truro Gas Company have given notice to their consumers that, on and after the 1st prox., the price of gas will be uniformly 3s. 9d. (instead of 4s. 9d.) per 1000 cubic feet, subject to a discount of 4d. to consumers of 10,000 feet and upwards per quarter, and a discount of 1d. per 1000 cubic feet to consumers of any less quantity.

Grand Junction Water-Works Company.—The report of the Directors of this Company which will be presented to the shareholders at their half-yearly general meeting to-morrow states that there was a steady increase in the water-rental in the six months ending in March last; but that, on the other hand, owing chiefly to the effects of severe frost, the expenditure had been heavier than usual. The Directors recommend a dividend at the rate of 8½ per cent. per annum on the ordinary capital, 7½ per cent. per annum on the "C" shares, and 7 per cent. per annum on the "D" shares.

Buenos Ayres Water Supply and Drainage Company.—News has at length come to hand from Buenos Ayres, says *The Times*, that the difficulty which has prevented a settlement being arrived at between the Government of the Argentine Republic and the Buenos Ayres Water-Works and Drainage Company is on the point of being arranged. With the removal of this obstacle to an agreement on the subject of the liquidation of the exterior debt of the Republic on the lines proposed some time back by Dr. Romero, it is believed that the more important question is on the eve of a satisfactory solution.

Electric Lighting at Brighton.—An inquiry was held at Brighton on Wednesday last by Mr. T. Codrington, for the Local Government Board, into an application by the Town Council for sanction to borrow £8200 for purposes of electric lighting. Mr. Boxall, who represented the Corporation, stated that two loans of £32,500 and £8500 respectively had been sanctioned, and an inquiry had been held in respect to a third loan (for £37,700); but, owing to certain modifications of the original plans and estimates which were found necessary, the total excess of expenditure on the first two loans had been £8212. The present application was for sanction to a loan to cover this additional outlay. There was no opposition.

Southwark and Vauxhall Water Company.—The report of the Directors of this Company for the six months to March 31 last states that the number of domestic supplies taken into charge during the half year is 676, estimated to produce an additional annual rental of £1215. The expenses of maintenance have been exceptionally increased, in consequence of the long and severe frost of last winter; and, in view of the extraordinary expenses to which the Company are subjected in order to lay the necessary evidence before the Royal Commission on Water Supply, and to defend the shareholders' interests in Parliament, the Directors recommend dividends at the rate of 5 per cent. per annum on the preference stock, and 6 per cent. per annum on the ordinary stock and "D" shares.

Misusing Bradford Corporation Water.—At the Bradford Borough Court last Wednesday, Messrs. W. and M. Thompson Black and Co., of Victoria Mills, Bowling, were charged by the Bradford Corporation with fixing an appliance to one of their water-mains without their knowledge. The Town Clerk (Mr. W. T. M'Gowen) said the Corporation Water Manager (Mr. J. Watson) visited the defendants' premises, and found that a pipe had been attached to the main by which water was conveyed into a condensing-tank without being registered by the meter. Mr. Warren, who appeared for defendants, admitted that his clients had been guilty of a technical offence, but said the Corporation servants had made a most disgraceful and unfounded charge against them. There had been an understanding between the defendants and an assistant manager of the water-works that extra pipes should be laid, in order to make up the deficiency arising from reduced pressure. The Stipendiary pointed out that the charge did not impute fraud; and he inflicted a fine of 30s. and 8s. costs.

Reduction of the Gas-Rate at Spalding.—The Spalding Improvement Commissioners propose to reduce the gas-rate for the ensuing year from 8d. to 4d. in the pound. This reduction is due to the successful management of the gas-works (which are under the care of Mr. J. G. Hawkins), and to the completion of the payment of the loan.

Sales of Shares.—Last Tuesday, Mr. Simeon Joel sold by auction, at Newcastle, £50,000 of 5 per cent. preference stock in the *Newcastle and Gateshead Water Company*, at prices ranging from £148 to £151 10s. per cent. The total amount realized was £74,823 10s.——At the Auction Mart, Tokenhouse Yard, E.C., last Wednesday, Messrs. Fox and Bousfield sold some £10 shares in the *Cape Town and District Gas Company* at £4 2s. 6d. to £4 10s. each.——At Bradford last Thursday, Messrs. W. G. Stansfield and Co. sold by auction 50 £10 shares in the *Clayton, Allerton, and Thornton Gas Company* at £16 each; also £284 of 10 per cent. stock of the *North Bierley Gas Company*, at £2 3s. per £1.

Colne Local Board Gas Supply.—The Chairman of the Gas Committee of the Colne Local Board (Mr. J. Hartley) has presented his annual statement. He says the receipts in the past financial year aggregated £13,710, which included £9813 for gas-rental, or £439 more than in the preceding twelve months. The expenditure included £9933, the gross cost of making the gas; and the interest on loans and sinking fund amounted to £2867, or £621 less than before. The total expenditure was £12,800; leaving a balance of £910 to hand over for the benefit of the district rate. He adds that about three years ago, the Local Government Board sanctioned the borrowing of £22,000, about £19,500 of which had been spent in remodelling the works.

Fire at the Rochdale Gas-Works.—A fire, which caused some amount of excitement in the town, occurred in the tar-works at the Rochdale Corporation Gas-Works during the evening of last Wednesday week. It appears that, after being distilled, the tar eventually overflows on to a large cooling-floor, sunk a few feet below the level of the ground. This floor is covered by a light sheet-iron building, to prevent the smell of the molten pitch becoming a nuisance to the people of the neighbourhood. On the evening in question, the tar had just finished flowing over, and the building was full of somewhat inflammable gas, when, by some unknown means, this took fire. A dense black smoke was emitted, out of all proportion to the size and importance of the fire; and this, covering a portion of the town, gave people the idea that something alarming had happened. There was, however, very little damage done—indeed, it is estimated at less than £80.

The Inspection of Gas-Fittings in New Buildings in Leeds.—The following is the text of the clause as to the inspection of gas-fittings in new buildings which has been embodied in the Leeds Corporation (Consolidation and Improvement) Bill, and is referred to in our editorial columns: "Every person intending to lay down or fix any pipes or other fittings which are intended to be covered over for the distribution and supply of gas by the Corporation in any new house, building, or premises within the gas limits, shall, before such pipes or fittings are plastered or covered over, give to the Corporation 24 hours' notice in writing, specifying the situation of such house, building, or premises, and any officer of the Corporation duly appointed for that purpose may, before the expiration of such notice, enter such house, building, or premises to inspect and test such pipes or fittings, and may prohibit any arrangement or the use of any pipes or fittings which, in the opinion of such officer, will be likely to occasion danger or the escape of gas; and until the pipes or fittings are altered to the reasonable satisfaction of such officer, or if any person shall fail to give such notice as aforesaid, or shall refuse such officer admittance into such house, building, or premises within the time and for the purposes aforesaid, or shall prevent him from making such inspection, the Corporation shall not be bound to furnish to such person a supply of gas for such house, building, or premises."

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

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HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

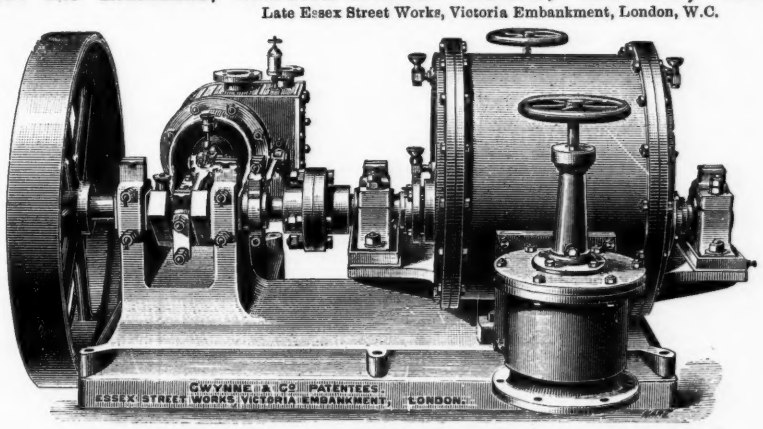
Late Essex Street Works, Victoria Embankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



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GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

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Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

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Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
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Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
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PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
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YOUNG Man (aged 27) requires Situation as METER INSPECTOR. Good references.
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YOUNG Man (23) seeks Situation in Gas- Works, home or abroad. Nine years' experience (Seven articled to Manager). Is a good Draughtsman, Chemist, and Photometrist, and can keep books. First-class testimonials.
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WANTED, a Situation as Manager of a Tar Distillery, at either a Gas-Works or Private Yard. Advertiser has a thorough practical knowledge of every branch of Tar Distilling and Ammonia Making. Could undertake erection of a new Plant.
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GAS Engineer, thoroughly practical, is open to an ENGAGEMENT, and would undertake charge of large or medium-sized Works during absence of Engineer. Security and highest references.
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LEADING Stoker wanted, Steady and reliable, and used to Engine and Exhauster. Wages 28s. per week.
Address the MANAGER, Hoddesdon Gas-Works Broxbourne, HERTS.

TRAVELLER or Agent Wanted, on Commission, with first-class connection among Gas Companies in the South, Midlands, and North of England. Liberal Terms.
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HINCKLEY LOCAL BOARD.

WANTED, as Manager of Gas-Works, one who has been accustomed to, and thoroughly understands the Manufacture and Distribution of, Gas and the General Supervision of a Gas-Works. To reside on the Premises; House, Gas, and Coals found.
Applicants must state age, previous experience, and salary (not exceeding £100) required, and give not more than three testimonials of efficiency of recent date; also state how soon they can commence duty.
Applications, endorsed "Gas Manager," to be sent in to the undersigned on or before Monday, June 19.
Canvassing members will disqualify.
F. S. PRESTON,
Clerk to the Board.

EXHAUSTER (Rotary), perfectly New (Makers, Dempster and Sons), 20,000 cubic feet per hour, ON SALE, cheap.
Apply to T. G. MARSH, 41, Corporation Street, MANCHESTER.

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FOR SALE—A set of Four Purifiers, each 5 feet square, with Grids, &c., lying at the Filey Gas-Works.
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*** See Advertisement p. III., centre of JOURNAL.
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First-Class Award, Melbourne Exhibition, 1880, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
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THE Advertiser is prepared to Sell or LET ON HIRE two RAILWAY TANK-WAGGONS, nearly new. Suitable for Tar or Gas Water, &c.
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COLNE AND MARSDEN LOCAL BOARD.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the supply of from 5000 to 8000 tons of GAS COALS during the next Twelve Months.
Forms of Tender and any further Information can be obtained from the undersigned, to whom tenders must be sent on or before the 30th of June.
HY. SIMMONDS,
Engineer and Manager.
Gas-Works, Colne,
June 8, 1893.

SPECIAL BARGAIN.

FOR SALE—Two perfectly new Cast- Iron SCRUBBERS, 10 feet diameter by 50 feet high, with Wrought-Iron Domes, Cast-Iron Spiral Staircase, &c., complete. All plates machine planed. One or both Scrubbers will be sold to suit purchasers.
A perfectly new 30,000 per hour HORIZONTAL DOUBLE PUMP RECIPROCATING EXHAUSTER, with Steam-Engine, with Connections and Valves.
One Second-hand (thoroughly overhauled) VERTICAL PUMP EXHAUSTER, with Steam-Engine (with clean Water and Liquor Pumps attached), to pass 7000 cubic feet of Gas per hour.
One Second-hand (thoroughly overhauled) ROTARY EXHAUSTER, to pass 7000 cubic feet per hour (without Engine), fitted with Pulleys.
The whole of the above Plant can be inspected, and full particulars with prices will be sent, on application to No. 2241, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

LONGWOOD GAS COMPANY.

TAR AND LIQUOR.

THE Directors of the above Company are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR made at their Works during the Year commencing July 1, 1893.
The Liquor to be 5° Twaddel.
The estimated quantity for disposal is about 950 tons.
Sealed tenders, endorsed "Tar and Liquor," addressed to the Chairman, Gas Offices, Longwood, Huddersfield, to be sent in not later than Tuesday, June 20, 1893.
By order,
JOHN LOWE MITTON,
Manager and Secretary.

TENDERS FOR COAL.

THE Directors of the Longwood Gas Company invite TENDERS for the supply of from 1000 to 5000 tons of the best screened and also unscreened GAS COAL, to be delivered during the year ending June 30, 1894, in the Station Siding, Longwood, in such quantities as may be required by their Gas Engineer.
Tenders, sealed and endorsed "Gas Coal," addressed to the Chairman, Gas Offices, Longwood, Huddersfield, may be sent in not later than June 20, 1893.
By order,
JOHN LOWE MITTON,
Manager and Secretary.

IRISH BOG ORE OXIDE OF IRON.

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BALE & CO., direct Importers from Ireland. Sample and Price on application.
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FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

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Head Office: MIDDLESBROUGH. Correspondence invited.

TIPTON GAS-WORKS.

COAL CONTRACTS.

THE Gas Committee of the Tipton Local Board invite TENDERS for the supply of GAS COAL for a period of One, Two, or Three Years, from the 1st of July next, in annual quantities of about 10,000 tons, to be delivered, carriage free, to the Gas-Works Siding (L. & N. W. Railway).
Specification and Form of Tender may be obtained at the Gas-Works, on application to Mr. Vincent Hughes, the Engineer and Manager.
Sealed and endorsed tenders to be sent to me, the undersigned, not later than Ten a.m., on Friday, the 23rd inst.
The Committee do not bind themselves to accept the lowest or any tender.
By order,
GEO. M. WARING,
Clerk to the Board.
Public Offices, Tipton,
June 1, 1893.

TIPTON GAS-WORKS.

TAR CONTRACTS.

THE Gas Committee of the Tipton Local Board invite TENDERS for the purchase of the surplus TAR produced at the above Works during a period of One, Two, or Three Years from the 1st of July next.
Particulars may be had at the Gas-Works on application to Mr. Vincent Hughes, the Engineer and Manager.
The Tar may be delivered either into Boats or on Rail (L. & N. W. Railway) as may be required.
Sealed and endorsed tenders to be sent to me, the undersigned, not later than Ten a.m., on Friday, the 23rd inst.
The Committee do not bind themselves to accept the highest or any tender.
By order,
GEO. M. WARING,
Clerk to the Board.
Public Offices, Tipton,
June 1, 1893.

COUNTY BOROUGH OF BURY.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Gas Committee of the Corporation of Bury are prepared to receive TENDERS for the supply of GAS COAL and CANNEL for One, Two, or Three Years, commencing on the 1st day of July next, to be delivered free at the Corporation Siding, Bury, in such quantities as may be required from time to time.
Estimated quantity, about 27,000 tons of Coal, and 3000 tons of Cannel per annum.
Full Particulars and Form of Tender may be obtained on application to Mr. Gendall, Manager at the Gas-Works, Elton, Bury.
Sealed tenders, endorsed "Tender for Coal and Cannel," to be sent to me, the undersigned, on or before Saturday, June 24, 1893.
The Corporation do not bind themselves to accept the lowest or any tender.
JOHN HASLAM,
Town Clerk.
Corporation Offices, Bury,
May 28, 1893.

CORPORATION OF LEICESTER.
(Gas Department.)

EXHIBITION OF GAS COOKING-STOVES, ETC.

THE Gas Committee of the above Corporation intend holding an EXHIBITION OF GAS COOKING AND HEATING STOVES, ENGINES, AND OTHER GAS APPARATUS, in the Floral Hall, Leicester, from the 10th to the 15th of July next. They will provide Space, Gas, and Service-Pipes free.

Intending Exhibitors will be furnished with printed Conditions, Forms of Application for Space, and any further Information, on application to

Alfred Colson, M.Inst.C.E.,
Engineer and Manager.

Gas Offices, Millstone Lane,
Leicester, June 10, 1893.

COUNTY BOROUGH OF OLDHAM.

THE Gas-Works Committee are prepared to receive TENDERS for the supply of about 82,000 tons of CANNEL and COAL required by them during the Year ending the 31th of June, 1894.

Specifications and Forms of Tender can be obtained on application to Mr. Herbert Andrew, Gas and Water Offices, Oldham, to whom tenders are to be sent on or before Tuesday, the 27th of June, 1893.

A. Nicholson,
Town Clerk.

Oldham, June 8, 1893.

THE Directors of the Farnworth and Kearsley Gas Company are prepared to receive TENDERS for the surplus TAR and AMMONIACAL LIQUOR to be produced at their Works for One or more Years from the 1st day of July next.

Sealed tenders, addressed to James Warburton, Esq., Chairman, to be delivered at the Gas Offices on or before Saturday, the 24th inst.

Any further particulars required may be obtained on application to Mr. T. L. Sheppard, Manager.

THE Directors of the Kildwick Parish Gas Company invite TENDERS for the supply of the whole or a part of 3000 tons of best screened GAS COAL or NUTS, to be delivered free at Kildwick, during the Twelve Months ending July 31, 1894.

The Coal to be delivered at such times and in such quantities as the Manager may direct.

Tenders to be sent in not later than June 24, 1893, endorsed "Tender for Gas Coal."

The lowest or any tender not necessarily accepted.

Fred. H. Pickles,
Manager and Secretary.

Gas-Works, Kildwick,
June 10, 1893.

THE Haworth Local Board of Health are prepared to receive TENDERS for the supply of 1800 tons of screened and unscreened GAS COAL to be delivered (in such quantities as the Board may determine) on Rails at the Haworth Railway Station within the ensuing Twelve Months.

Tenders to be forwarded to me, the undersigned, marked "Coal Tender," on or before the 29th inst.

Wm. Robertshaw,
Clerk.

5, Temple Street, Keighley,
June 10, 1893.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Tottenham and Edmonton Gaslight and Coke Company invite TENDERS for the purchase of the surplus TAR to be produced at their Works during the Twelve Months ending the 30th of June, 1894—viz., about 300,000 gallons.

The Tar can be cleared either by Railway Tanks or by Road Tanks, for cartage to the River Lea (about 1 mile distant).

Tenders must be in by Nine a.m., on Friday, the 30th inst.

Forms of Tender, together with Conditions, may be had on application to W. H. H. Broadberry, Engineer.

By order of the Board,
Jas. Randall,
Secretary.

Gas-Works, Tottenham, June 9, 1893.

MANSFIELD CORPORATION.
(Gas Department.)

THE Gas Committee invite Tenders for their surplus TAR for One Year ending on the 30th of June, 1894.

The Tar to be removed by the Contractor when required by the Manager.

Monthly payments to be made.

The Committee do not bind themselves to accept the highest or any tender.

Tenders to be sent in on or before the 25th of June, 1893, endorsed "Tender for Tar," and addressed to

R. J. Parsons,
Town Clerk.

Mansfield, June 10, 1893.

CORPORATION OF STALYBRIDGE.

TAR AND AMMONIACAL LIQUOR.

THE Gas Committee of the above Corporation invite TENDERS for the purchase of the AMMONIACAL LIQUOR and surplus TAR produced at their Works for a term of One Year from the 1st day of July, 1893.

Conditions of Tender and necessary Particulars will be supplied on application to the undersigned.

Tenders, endorsed outside, to be addressed to the Chairman of the Gas Committee by the 17th of June.

The Committee do not bind themselves to accept the highest or any tender.

By order,
Ernest A. Loam,
Engineer and Manager.

Gas Offices, Stalybridge,
May 31, 1893.

ALFRETON GAS COMPANY.

TAR AND AMMONIACAL LIQUOR.

THE Directors of the Alfreton Gaslight and Coke Company invite TENDERS for the purchase of the AMMONIACAL LIQUOR and surplus TAR produced at their Works for a term of One Year from July 1, 1893, to June 30, 1894.

Tar, about 90 tons; Ammoniacal Liquor, about 250 tons.

The Directors do not bind themselves to accept the highest or any tender.

Thos. Forrett,
Secretary and Manager.

Gas-Works, Alfreton.

ROCHESTER, CHATHAM, AND STROOD GAS-LIGHT COMPANY.

THE Directors are prepared to receive TENDERS for the supply of HYDRAULIC MAINS, ASCENSION-PIPES, and other FITTINGS for a Retort-Bench.

Copies of Specification may be had and Plans seen in usual office hours, at the Offices, of the Company.

Tenders, marked "Retort-Fittings," to be delivered here before Noon of Thursday, June 29, 1893.

William Syms,
Secretary.

Gas Offices: 58, High Street,
Rochester, June 1, 1893.

TENDERS FOR COAL.

THE Directors of the Harlow and Sawbridgeworth Gaslight and Coke Company are prepared to receive TENDERS for the supply of from 700 to 800 tons of good screened GAS COAL, delivered, at Harlow Station free, in quantities of not less than 50 tons.

Tenders to be sent to Mr. J. E. Taylor, of Sawbridgeworth.

Sealed tenders, marked "Tender for Gas Coal," to be sent in on or before July 1, 1893.

The Directors do not bind themselves to accept the lowest or any tender.

SURPLUS TAR.

THE Gas Committee of the Corporation of Coventry are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Works, Coventry, for One Year from July 1 next.

Make, about 1500 tons per annum.

Tenders, stating price per ton delivered into Boat, to be addressed to the Manager not later than June 17, and marked "Tender for Tar."

The Committee do not bind themselves to accept the highest or any tender.

Geo. Winstanley, Assoc.M.Inst.C.E.,
Manager.

Gas-Works, Coventry,
June 6, 1893.

MARKET HARBOROUGH GAS COMPANY.

TO COKE DEALERS, ETC.

THIS Company have for disposal about 200 tons of the best made COKE.

Marked tenders, stating price and quantity required, to be sent to the undersigned by the 15th inst.

The Coke will be delivered at Market Harborough Station.

C. Burgoine,
Secretary.

June 6, 1893.

TO CONTRACTORS.

THE Market Harborough Gas Company invite TENDERS for
2000 tons of screened GAS COAL.
100 tons of LIME.

The Coal must be sent in monthly and as directed by the Manager, Mr. F. Armitage, of whom any further information may be obtained.

Tenders, giving price per ton at Market Harborough Station, to be sent to Wm. Gilbert, Esq., Northampton Road, Market Harborough, by the 15th inst.

The lowest or any tender not necessarily accepted.

Chas. Burgoine,
Clerk.

June 3, 1893.

FENTON URBAN SANITARY DISTRICT.
(Gas Department.)

THE Gas Committee invite Tenders for the supply and delivery of 3000 tons of good GAS COAL or BURGY.

Form of Tender and Particulars may be obtained from the Manager.

Tenders to be sent in on or before Tuesday, the 20th inst., marked "Tender for Coal," and addressed to the Chairman, Gas-Works, Fenton.

F. H. Darwin,
Manager.

Gas Offices, Fenton,
June 1, 1893.

NORTHWICH GAS COMPANY.

TENDERS are invited for the supply and delivery at Northwich Railway Station of about 3500 tons of good GAS COAL during the ensuing Twelve Months.

Tenders are also required for the supply and delivery of LIME and SULPHURIC ACID during the same period.

Any further Particulars required may be had on application to Mr. S. S. Mellor, Manager.

Tenders, endorsed, and addressed to the Chairman, must be delivered here not later than Ten a.m., on Saturday, June 24.

Hy. Pickering,
Secretary.

Gas-Works, Northwich,
June 7, 1893.

CAST-IRON PIPES.

THE Gas Committee of the Cockermouth Local Board invite OFFERS for the supply of about 700 yards of 7-inch PIPES.

Particulars from the undersigned.

Tenders to be in by Monday, the 26th of June.

Er W. Smith,
Gas Manager.

COUNTY BOROUGH OF HUDDERSFIELD.

GAS COAL.

THE Gas Committee are prepared to receive TENDERS from Colliery Proprietors for the supply and delivery of 50,000 tons of GAS COAL.

Form of Tender and full Particulars may be obtained on application to Mr. W. R. Herring, Engineer, Gas-Works, Huddersfield.

Sealed tenders, endorsed "Tender for Coal," to be addressed and sent to him not later than Friday, the 16th of June, 1893.

By order,
H. Barber,
Town Clerk.

Huddersfield, June 2, 1893.

THE Hindley Local Board are prepared to receive TENDERS for the supply of GAS COAL, THROUGH AND THROUGH, COBBLES, NUTS, SLACK CANNEL, and LIME, required at their Gas-Works during the ensuing Twelve Months; and also for the purchase of the TAR and AMMONIACAL LIQUOR produced at their Gas-Works during the ensuing Twelve Months.

Full Particulars, with Forms of Tender, can be obtained on application to Mr. Wm. Dickinson, Gas and Water Manager.

Sealed tenders, endorsed "Tender for Gas Coal," &c., to be lodged with the undersigned not later than Monday, June 19, 1893.

By order,
Stephen Holt,
Clerk to the Local Board.

Offices: Cross Street, Hindley,
June 1, 1893.

LEIGH LOCAL BOARD.

THE Gas Committee of the Leigh Local Board invite TENDERS for the supply of GAS COAL or NUTS, and ROUND CANNEL or CANNEL NUTS, for a period of One or Two Years, commencing on the 1st of July next.

The quantity required is 9000 tons of Coal, and 1000 tons of Cannel yearly.

Specifications, with Tender Forms and all Particulars may be had from the undersigned.

Sealed tenders, endorsed "Coal" or "Cannel," and addressed to the Chairman of the Gas Committee, to be delivered at the Town Hall, Leigh, not later than Monday, the 19th inst.

The lowest or any tender not necessarily accepted.

Alfred T. Fletcher,
Engineer and Manager.

Gas-Works, Leigh, Lancs.,
June 3, 1893.

TENDERS FOR COAL.

THE Rhyl Improvement Commissioners are prepared to receive TENDERS for the supply of about 3000 tons of GAS COAL, to be delivered during the Year ending June 30, 1894, carriage free, at their Siding (L. & N.W. Railway), Rhyl.

Sealed tenders, accompanied by Analysis, to be addressed to the Chairman of the Gas Committee, and endorsed "Tender for Coal," must be delivered at the Gas Office, Town Hall, not later than Monday, June 19, 1893.

Forms of Tender, with Conditions, may be obtained on application to the undersigned.

The lowest or any tender will not necessarily be accepted.

Leonard G. Hall,
Manager.

Gas-Works, Rhyl,
June 8, 1893.

NEW MILLS LOCAL BOARD.

THE Gas Committee of the New Mills Local Board are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works from July 1, 1893, to June 30, 1894.

Particulars may be obtained on application to the Manager, Mr. E. Jones, Gas Office, New Mills.

Tenders, to state price per ton of 20 cwt. at the Works or at Midland Goods Station. The tender for Liquor to state price per ton of 5° and upwards.

Tenders, endorsed "Tar and Liquor," to be addressed to the Chairman, Local Board, and to be sent in not later than Twelve o'clock Noon, on the 20th of June next.

The Committee do not bind themselves to accept the highest or any tender.

John Pollitt,
Clerk.

Town Hall, New Mills,
May 29, 1893.

LINCOLN CORPORATION.
(Gas Department.)

TENDERS FOR TAR AND AMMONIACAL LIQUOR.

THE Gas Committee of the Corporation of Lincoln are prepared to receive TENDERS for the purchase of the Surplus TAR, and of the whole of the AMMONIACAL LIQUOR produced at their Works during the period of One Year, commencing on the 1st of July, 1893.

Sealed tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Residuals," must be delivered at the Gas Offices, Newland, on or before the 26th inst.

The Committee do not bind themselves to accept the highest or any tender.

Information as to quantities and other particulars may be obtained of the undersigned.

Jno. Carter, Manager.

Gas-Works, Lincoln,
June 5, 1893.

TENDERS FOR COAL.

THE Directors of the Isle of Thanet Gas Company invite TENDERS for the supply of 12,000 tons of the best NEWCASTLE GAS COAL, to be delivered either into their Lift-Waggon on the Company's Premises, or f.o.b. Vessels in the Tyne, in equal monthly quantities, for One, Two, or Three Years, commencing delivery Sept. 1, 1893.

Sealed tenders, endorsed "Coals," to be sent in on or before Thursday, June 29, addressed to the Chairman of the Company.

The Directors do not bind themselves to accept the lowest or any tender.

Forms of Tender may be obtained on application to the undersigned.

THOMAS C. FULLER,
Secretary.

Gas-Works, Margate,
June 8, 1893.

TENDERS FOR FREIGHT.

THE Directors of the Isle of Thanet Gas Company invite TENDERS for the FREIGHT and CARTAGE of 12,000 tons of Coal from the Tyne to the Margate Gas-Works for One, Two, or Three Years.

The Directors do not bind themselves to accept the lowest or any tender.

Tenders, endorsed "Freight," to be sent in on or before Thursday, June 29, 1893, addressed to the Chairman of the Company.

Full Particulars may be had on application to the undersigned.

THOMAS C. FULLER,
Secretary.

Gas-Works, Margate,
June 8, 1893.

GAS COAL AND CANNEL.

THE Gas Committee of the Carnarvon Corporation invite TENDERS for the supply of 1700 tons (more or less) of good GAS COAL and about 150 tons (more or less) of CANNEL or CANNEL NUTS, delivered as required during the Year ending Aug. 31, 1894, free in Trucks at Carnarvon Railway Station, L. & N.W. Railway.

Full Particulars may be obtained from the undersigned.

Sealed tenders, endorsed "Tender for Coal and Cannel," and addressed to the Chairman of the Gas Committee, Guildhall, Carnarvon, to be delivered on or before Thursday, June 22, 1893.

The Committee do not bind themselves to accept the lowest or any tender.

THOMAS WILKINSON,
Manager.

Corporation Gas Office, Carnarvon,
June 9, 1893.

CARNARVON CORPORATION GAS-WORKS.

THE Gas Committee of the Carnarvon Corporation invite TENDERS for the supply of a combined ENGINE and EXHAUSTER and COMPENSATING GOVERNOR complete, to pass 5000, 7000, and 10,000 cubic feet per hour; also a LOWE JET PHOTOMETER.

Further Particulars may be obtained from the undersigned.

Sealed tenders, endorsed "Tender for Gas Exhauster, &c.," and addressed to the Chairman of the Gas Committee, Guildhall, Carnarvon, to be delivered on or before Thursday, June 22, 1893.

The Committee do not bind themselves to accept the lowest or any tender.

THOMAS WILKINSON,
Manager.

Corporation Gas Office, Carnarvon,
June 9, 1893.

CORPORATION OF LANCASTER.
(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee are prepared to receive TENDERS for the supply of GAS COAL, delivered, on the Gas-Works Siding, Lancaster, in such quantities and at such times as may be required during a period of One, Two, or Three Years, commencing delivery Aug. 1 next.

Sealed tenders, endorsed "Gas Coal," giving full particulars of the Coal offered, must be delivered to W. O. Roper, Esq., Town Clerk, Lancaster, on or before the 19th day of June next.

Forms of Tender may be obtained on application to the undersigned.

The lowest or any tender not necessarily accepted.

CHAS. ARMITAGE,
Manager.

Gas-Works, Lancaster,
May 25, 1893.

MANCHESTER CORPORATION GAS-WORKS.

TO GASHOLDER MAKERS.

THE Gas Committee of the Manchester Corporation are prepared to receive TENDERS for the construction of a THREE-LIFT TELESCOPIC GASHOLDER, having a total capacity of 7,000,000 cubic feet, at their Bradford Road Gas-Works.

General Conditions and Specification and Quantities can be obtained on application (in writing only) to Mr. C. Nickson, Superintendent of the Gas Department, Town Hall. A deposit of Three Guineas, which will be returned on receipt of a *bonâ fide* tender, must accompany each application for Particulars and Tender Form.

The Committee do not bind themselves to accept the lowest or any tender.

Sealed tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Gasholder," must be delivered at the Gas Offices, Town Hall, not later than Ten o'clock a.m. on the 1st of July, 1893.

By order of the Gas Committee,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
June 2, 1893.

CITY OF CARLISLE.

TENDERS FOR COAL AND CANNEL.

THE Carlisle Gas Committee are prepared to receive TENDERS for the supply of about 16,000 tons of screened or unscreened GAS COAL, and about 4000 tons of CANNEL, to be delivered at their Works in Carlisle in such quantities as may be directed, from July, 1893, to June, 1894.

Tenders, specifying the description of the Coal or Cannel, the Pits at which they are raised, and the terms for the net monthly payment, are to be sent on or before June 30, 1893, endorsed "Tender for Coal."

Forms of Tender to be had from

J. HEPWORTH,
Engineer.

Gas Works, Carlisle,
June 7, 1893.

CITY OF CARLISLE.

TAR CONTRACT.

THE Carlisle Gas Committee are prepared to receive TENDERS for the surplus TAR to be produced at their Works, for a period of One or more Years from the 31th of June next.

Any further Particulars required can be obtained upon application to the Engineer, to whom sealed tenders, endorsed "Tender for Tar," must be delivered on or before June 30, 1893.

The Committee do not bind themselves to accept the highest or any tender.

J. HEPWORTH,
Engineer.

Gas-Works, Carlisle,
June 7, 1893.

YORKTOWN AND BLACKWATER GAS AND COKE COMPANY, LIMITED.

TENDERS are invited for the supply of about 800 tons of really good GAS COAL (more or less) to be delivered in quantities of about 60 tons, carriage paid, at the Blackwater Station, S.E. Railway, as required at the Works, with seven days' notice, between the 1th of July, 1893, and the 10th of July, 1894.

Sealed tenders, marked "Tender for Coals," addressed to the Secretary, before the 24th of June next, will be considered by the Directors at their meeting immediately after.

The Directors do not bind themselves to accept the lowest tender.

Net cash monthly.

June 10, 1893.

THE Gas Committee of the Leeds Corporation are prepared to receive TENDERS for the supply of about 240,000 tons of best GAS COALS (Screened or Nuts).

Price per ton to be quoted, delivered at their Gas-Works, Meadow Lane (Hunslet Lane Siding), New Wortley (Gelderd Junction Siding), or at the Gas-Works, York Street, in such quantities as may be required.

The Contract to commence the 1st of July next, and terminate, June 30, 1894.

Forms of Tender may be obtained on application to Mr. Lupton, General Superintendent, Gas Department, Municipal Offices, Calverley Street.

Tenders may be for any portion of the total quantity required, and will be received not later than the 30th inst., addressed to the Chairman of the Gas Committee, Municipal Offices, Calverley Street, and endorsed "Tender for Coal."

The lowest or any tender will not necessarily be accepted.

June 19, 1893.

BOROUGH OF NEWBURY.
(GAS DEPARTMENT.)

THE Gas Committee are prepared to receive TENDERS for the supply of 2600 tons of best screened GAS COAL, to be delivered free to the Newbury Station (G.W.R.), in such quantities as the Manager may from time to time require between Sept. 1, 1893, and July 31, 1894.

The Coal offered must be guaranteed free from Bats, Dross, or other objectionable matter, the Pit from which it is raised must be specified, and evidence of working results given.

No special Form of Tender is to be issued; and the Committee do not bind themselves to accept the lowest or any tender.

Tenders, endorsed "Gas Coal," to be delivered not later than Noon of the 20th inst., and addressed to the Chairman of the Gas Committee, Gas Offices, Newbury.

By order,
ROBERT M. COUPER,
Manager.

Gas-Works, Newbury,
June 9, 1893.

BOROUGH OF BURTON-ON-TRENT.

TAR.

THE Mayor, Aldermen, and Burgesses of the Borough of Burton-on-Trent, acting by the Council, invite TENDERS for the purchase of the surplus TAR, to be produced at their Works during Twelve Months from the end of July next.

Probable quantity of Coal carbonized during the Twelve Months, 25,000 tons.

The Tar will be delivered free into Contractor's Tank-Trucks, on the Gas-Works Railway Siding.

Payments, net cash, monthly.

Tenders sealed, and endorsed "Tender for Tar," are to be delivered to me, at or before Ten a.m., on Friday the 30th of June inst.

The highest or any tender will not necessarily be accepted.

F. L. RAMSDEN,
Manager and Engineer.

Gas-Works, Burton-on-Trent,
June 8, 1893.

HULL GASLIGHT COMPANY.

TENDERS FOR TAR.

THE Kingston-upon-Hull Gaslight Company invite TENDERS for the surplus TAR for One Year, the same to be sent in to the Chairman of the Company on or before the 26th of June, 1893.

Particulars may be obtained from

THOMAS HULL,
Engineer and Manager.

Gas-Works, Broadley Street, Hull.

THE Directors of the Ware Gaslight and Coal and Coke Company, Limited, invite TENDERS for the supply of from 900 to 1200 tons of EAST PONTOP, NEW PELTON, or PELAW MAIN GAS COALS, to be considered at their Meeting to be held on Tuesday, the 20th day of June inst.

Full Particulars may be obtained on application to me, the undersigned, at my Office.

Dated this 6th day of June, 1893.

By order of the Board,
GEO. H. GISBY,
Secretary to the Company.

Baldock Street, Ware.

SPALDING GAS-WORKS.

THE Spalding Improvement Commissioners invite TENDERS for the supply of 1500 tons of the best NEWCASTLE GAS COAL and 500 tons of the best SILKSTONE GAS NUTS (or any larger quantity of either kind that may be required), to be delivered in such quantities as shall be from time to time required and ordered by them, or by their direction, up to the 30th day of June, 1894.

Sealed tenders, to be endorsed "Tender for Coals," stating the price per ton delivered f.o.b. in the Tyne, or at the Spalding Railway Station, to be sent to the undersigned at the Office of the Commissioners, 8, Double Street, Spalding, on or before the 24th day of June inst.

The Commissioners will also receive TENDERS at the same time for the supply of 20 tons, or any greater or less quantity that may be required, of LIME suitable for Gas Purification, to be from time to time delivered at the Spalding Railway Station, in such quantities as shall be from time to time required up to the 30th day of June, 1894.

The Commissioners do not bind themselves to accept the lowest or any other tender.

H. H. HARVEY,
Clerk to the Commissioners.

Spalding, June 7, 1893.

COUNTY BOROUGH OF STOCKPORT.
(GAS DEPARTMENT.)

TENDERS FOR STORES.

THE Gas Committee are prepared to receive TENDERS for the supply of the following MATERIALS to June 30, 1894, viz.—

1. Bolts and Nuts.
2. Brushes.
3. Brass and Meter Fittings.
4. Cartage.
5. Casting.
6. Drysaltery.
7. Retorts and Fire Goods.
8. Glass, Red and White Lead.
9. Iron and Steel.
10. Ironmongery.
11. Lead, Pipe, Tin.
12. Mill Furnishing.
13. Oils and Tallow.
14. Purifier-Grids.
15. Ropes and Flax.
16. Shovels, Pick-Heads.
17. Timber, English and Foreign.
18. Tubing.
19. Wet and Dry Meters.
20. Stationery.

Forms of Tender and all further Information may be obtained on application to the Engineer, Mr. S. Meunier, Stockport.

No Form of Tender other than that issued by the Committee will be accepted.

Tenders, endorsed "Contract 1, 2, &c.," as the case may be, addressed to the Chairman of the Gas Committee, Millgate Works, Stockport, to be sent in on or before the 22nd of June, 1893.

No tender will be accepted without satisfactory proof that the firm tendering pays the standard rate of wages, and observes the standard number of hours.

The Committee do not bind themselves to accept the lowest or any tender.

WALTER HYDE,
Town Clerk.

June 9, 1893.

BOROUGH OF MACCLESFIELD.

THE Gas Committee are prepared to receive TENDERS for the supply of the undermentioned Materials and Carting required during a period of Twelve Months, commencing the 1st of July, 1893:—

(1) The best hand-picked BUXTON LIME, delivered fresh at Macclesfield, free from Dirt and Ashes, in such quantities as may be ordered.

(2) Wrought-Iron Lap-welded STEAM TUBES and FITTINGS.

(3) Cast-Iron MAINS and IRREGULARS.

(4) OILS, PAINT, and DRUGGISTS' SUNDRIES.

(5) CARTING.

(*a.*) Contractors to state price per ton over the Gas Committee's Weighing-Machine from the Railway Companies' Yards and Canal Wharf, Buxton Road.

(*b.*) Contractors to provide own Fillers, Horses Carts, Shovels, Props, and all Implements; also to arrange with the Railway Companies as to Waggons being placed in position and standing under load, and be answerable for all demurrage.

(*c.*) The particulars of the Waggons containing the materials to be emptied, and any other materials that require to be carted, will be furnished to the Contractor at the Gas Office each Morning at Eight o'clock.

Any further Information required can be obtained on application to Mr. Newbigging, Engineer, Gas-Works.

Sealed tenders, properly endorsed, to be addressed to the Chairman, Gas Committee, Town Hall, Macclesfield, and to be sent in not later than Saturday, the 24th of June, 1893.

The Committee do not bind themselves to accept the lowest or any tender.

W. FREDK. TAYLOR,
Town Clerk.

May 29, 1893.

DUKINFIELD LOCAL BOARD.

TENDERS FOR CANNEL AND COAL.

THE above Board invite Tenders for CANNEL and COAL by Thursday noon, the 22nd inst.

For Specification and Forms of Tender apply to

HARRISON VEEVERS,
Engineer.

Dukinfield, June 5, 1893.

GREAT WIGSTON GAS COMPANY.

TENDERS FOR COAL.

THE Directors invite Tenders for about 2000 to 2200 tons of best screened GAS COAL, delivered at the Railway Station, Wigston, for Twelve Months commencing July 1, 1893, in such quantities as the Manager shall from time to time order.

Tenders to be addressed to the Chairman not later than the 26th inst.

The Directors reserve to themselves the right to accept the lowest or any tender.

JOHN A. HARRIS,
Manager.

EAST LONDON WATER-WORKS COMPANY.

NOTICE is hereby given, that the TRANSFER BOOKS, in respect of the DEBENTURE STOCK only, WILL BE CLOSED on the 17th of June in t., and re-opened on the 1st day of July, 1893.

I. A. CROOKENDEN,
Secretary.

St. Helen's Place, London, E.C.,
June 9, 1893.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is hereby given, that the TRANSFER BOOKS of this Company so far as they relate to DEBENTURE STOCK and BONDS WILL BE CLOSED at Ten o'clock forenoon, on Saturday, the 17th inst., for the Half Year ending on the 30th of June, 1893, and will be re-opened on Monday, the 19th inst.

The Interest for the Half Year will be payable on the 1st day of July next to the Proprietors registered on the closing of the Books.

By order of the Board,
JAMES RANDALL,
Secretary.

Gas Offices: Willoughby Lane, Tottenham,
June 9, 1893.

BROMLEY GAS CONSUMERS' COMPANY.

SALE BY AUCTION OF 200 ORDINARY SHARES OF £10 EACH.

THE Directors give notice that they have instructed Messrs. Baxter, Payne, and Lepper, to SELL by AUCTION, at the Bell Hotel, Bromley, Kent, on Wednesday, the 21st of June, 1893, at Eight o'clock p.m. precisely, in lots of Five and Ten Shares each, 200 ORDINARY SHARES of £10 each in the Bromley Gas Consumers' Company.

The Dividend paid upon this class of Shares for the past Two Years has been at the rate of 8½ per cent. per annum.

Particulars and Conditions of Sale may be obtained of the SECRETARY of the Company; Messrs. WILLETT AND LATTER, Solicitors, Market Square, Bromley, KENT; and of the AUCTIONEERS, Market Square, Bromley, KENT.

By order,
H. W. AMOS,
Secretary

Price 6s., Cloth Bound, Bevelled Boards.

THE

GUIDE-FRAMING OF GASHOLDERS

AND OTHER PAPERS

CHIEFLY RELATING TO

STRAINS IN STRUCTURES CONNECTED WITH GAS-WORKS.

BY

F. SOUTHWELL CRIPPS, Assoc. M. Inst.C.E.

Reprinted from the JOURNAL OF GAS LIGHTING. *Fully Revised and Corrected by the Author, with many Additions.*

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

NOTICE OF REMOVAL.

TO GAS ENGINEERS & MANAGERS

CROWTHER BROS.,

Contractors for Retort Setting, Erection of Gas Apparatus, and General Repairs, have removed from 384, Mile End Road, to

152, TEVIOT ST., ST. LEONARD'S ROAD, POPLAR, LONDON, E.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 23, Alwyne Road, Canonbury, LONDON, N.

Prices are Reduced.

JAMES WHITE & CO., LTD.,

WIDNES, LANCASHIRE,

Manufacturers of Special

FIRE-BRICKS, FIRE-CLAY, & FURNACE CEMENT.

FOR GAS FURNACES our GANNISTER and SILICA FIRE-BRICKS are acknowledged to be the best and most durable in the Market.

GANNISTER and SILICA FIRE-CLAY guaranteed of the Purest Quality.

FURNACE CEMENT specially made for repairing Furnaces and stopping Cracks.

ANALYSIS AND REFERENCES ON APPLICATION.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production over 3200 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of over

400,000 Tons per Annum.

Full particulars on application to

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HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

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Improved Slide-Valve Anti-Dip.

Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.

Is cheap and easily fixed to any form of main.

Will be found the most efficient appliance of the kind yet introduced.

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GAS-WORKS, RUGBY.

(Late N. MEIKLEJOHN, Longwood.)

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REGENERATIVE FURNACES.

Unsurpassed in Efficiency, Economy, Durability, and Easy Working.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

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"CURLEY CANNEL."

YIELD: 15,306 CUB. FT. PER TON OF 30·62-CANDLE POWER.

SMOOTH CANNEL.

YIELD: 12,321 CUB. FT. PER TON OF 21·321-CANDLE POWER.

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PONTYBODKIN, nr. MOLD, NORTH WALES.

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A FIRST-CLASS CANNEL COAL,

Yielding a large volume of rich Gas, and fully 60 per cent. of first-class Coke.

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Telegrams: "BENHAR, Edinburgh."

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MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY

Strongly recommended where EXCESSIVE HEATS have to be maintained.

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FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

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SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

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BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,

Newcastle-on-Tyne.

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CAST-IRON PIPES

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Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

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Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

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THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE,

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Telegrams: "HUNTER PORT GLASGOW."

Established 1872.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. PATTINSON, Public Analyst for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a working Analysis made of these Coals by the Falmouth Gas Company:—

[COPY.]

FALMOUTH GAS COMPANY,
Offices: *Church Street, Falmouth,*
January 25th, 1893.

Messrs. the

WEARDALE IRON & COAL COMPANY, LTD.,

NEWCASTLE-ON-TYNE.

GENTLEMEN,

From the Cargo of **THORNLEY GAS COAL,** received early this month from you, I have Carbonized at these Works, during a period of thirteen consecutive days, 151$\frac{15}{20}$ tons of the Coal, mixed with 9$\frac{6}{20}$ tons of Cannel Shale (or about 6 per cent.)

The Make of Gas during the above period was 1,624,000 cubic feet.

The whole of the Gas was made from four beds of sixes (24 mouthpieces); each charge being of six hours' duration.

Gas made: 1,624,000 cubic feet.
Coal Carbonized: 151$\frac{15}{20}$ tons.
Cannel Shale: 9$\frac{6}{20}$ tons.
Make per ton of Coal and Cannel Carbonized: 10,082 cubic feet.
Coke per ton (of good quality): 13$\frac{1}{4}$ cwt.

The ILLUMINATING POWER averages from 11 daily tests, **16·54 CANDLES,** which was ascertained by burning the Gas at the rate of 5 cubic feet per hour in a certified Letheby Photometer, fitted with a Standard Argand, each Candle consuming 120 grains of Sperm per hour.

Yours faithfully,
J. WM. BUCKLEY,
Engineer and Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.,

QUAYSIDE, NEWCASTLE-ON-TYNE.

G. WALLER & Co.'s NEW PATENT GAS EXHAUSTER

MADE WITH FOUR BLADES,

To pass 300,000 Cubic Feet per Hour, with or without Engine combined.

IN USE AND ON ORDER FOR OVER 100 WORKS,

AND EQUAL TO

5,340,000 CUBIC FEET PER HOUR.

SPECIAL ADVANTAGES:—

The Four-Blade Exhauster **PASSES 50 PER CENT. MORE PER REVOLUTION** than any One or Two Blade Exhauster.
It takes 27 per cent. less power than any Two-Blade Exhauster.
It gives a steadier Gauge than any other Exhauster.
One of our 150,000 feet per hour Patent Four-Blade Exhausters passes continuously **180,000** cubic feet per hour, driven by a **12-INCH STEAM CYLINDER.** No other Maker can give a similar result.
Model of Patent Exhauster sent for inspection.
Oldest Makers of Beale Exhausters for over 300 Works.
Patent Compensating Steam Governor, Special Tar and Liquor Pumps, Gas-Valves.
Washer-Scrubbers, with **WOOD CLUSTERS,** and Tar Extractor combined.

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LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

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THOMAS TURTON AND SONS, LIMITED,

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MANUFACTURERS OF

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CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph Chemical, Colliery and other Companies.

NOTE. — Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

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BEST

REAL OLD SILKSTONE GAS COAL,

Address THE STRAFFORD COLLIERIES COMPANY,

Near BARNSLEY, SOUTH YORKSHIRE.

THE WIGAN COAL & IRON CO., LIMTD.,

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TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE NO. 200.

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RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.

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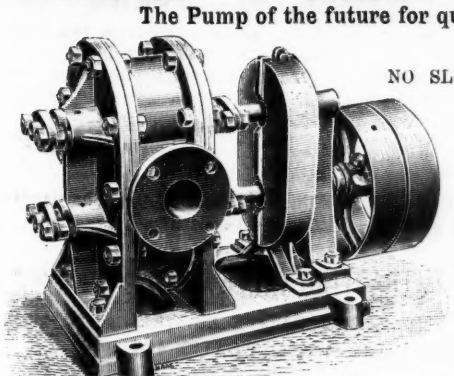
DRUM PUMP AND GAS EXHAUSTER.

The Pump of the future for quickly and economically moving large bodies of Water.



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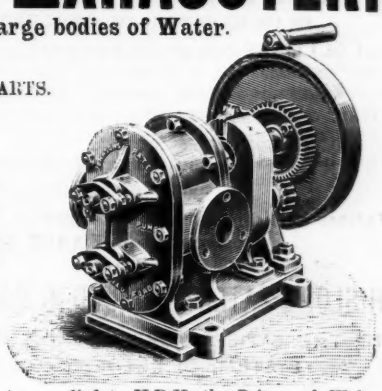
NO SLIDES OR FRICTIONAL WORKING PARTS.

The Centrifugal Pump has large capacity, but is limited in power. The direct-acting Piston Pump has great power, but is limited in capacity. The Drum has the capacity of the former with the power of the latter; the advantages of both, with the disadvantages of neither.



As supplied to H.R.H. the Prince of Wales for Pumping Gas Liquor at his Sandringham Gas-Works.

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GAS COAL AND CANNEL CONTRACTOR,

MANUFACTURER OF

A Special Compound for the cure of Stopped Ascension-Pipes. A couple of charges will clear a stopped Pipe, and an occasional charge keeps them clean; also increases the Make per ton and the Illuminating Power.

Prices and Particulars on Application. HEAD OFFICES: CORPORATION STREET, BIRMINGHAM. TELEGRAPHIC ADDRESS: "EVESON, BIRMINGHAM."

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TELEGRAPHIC ADDRESS: "WATERBLEAN MINES, MILLOM." PORTERAGE, 1s. 6d.

VENETIAN AND OXIDE REDS for the Manufacture of ANTI-CORROSIVE PAINTS.

Specially adapted for the Ironwork of Gas-Works and wherever subject to exposure.

G. J. EVESON, Proprietor, Corporation Street, Birmingham.

ORDERS TO BIRMINGHAM, OR DIRECT TO THE MINES.

HANNA, DONALD, & WILSON,

(Established 1851),

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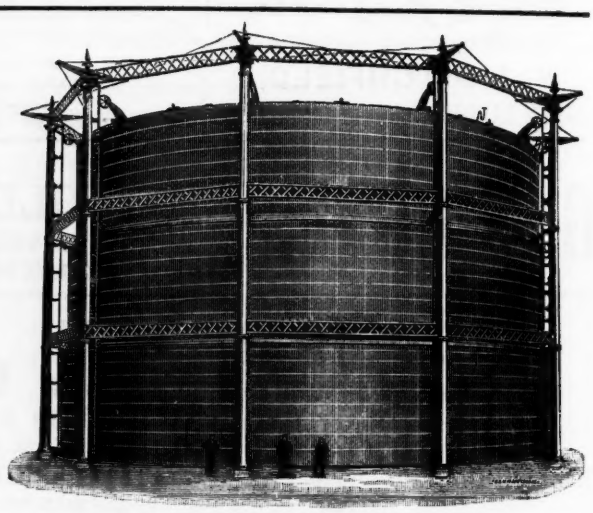
MAKERS OF

Gasholders and Gas Plant

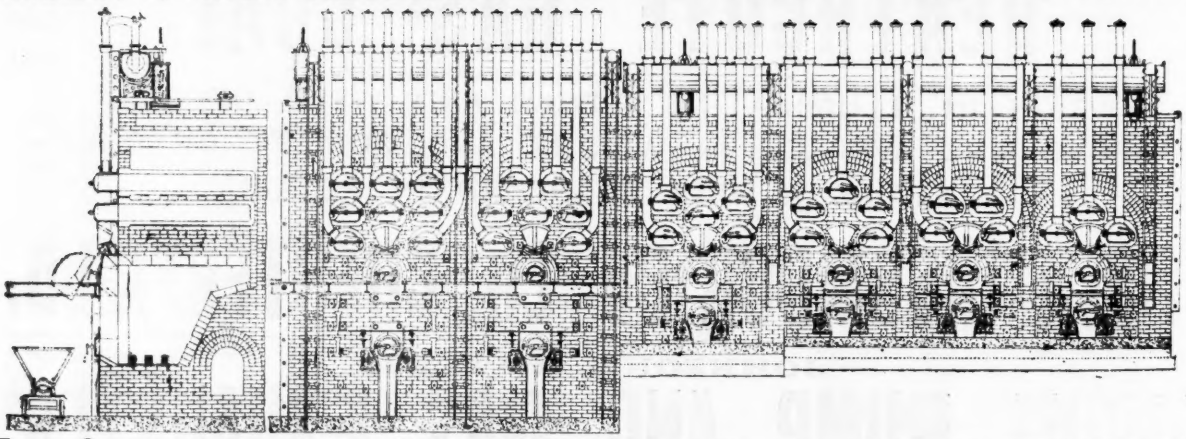
OF EVERY DESCRIPTION.



Sole Agents for Scotland for the Automatic Coal-Gas Retort (Inclined System) Company, Limited.

Telegraphic Address: "Donald Paisley."

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stewart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge, and from R. F. HISLOP (son of Patentee), Gas-Works, Paisley.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S PATENTS.

All Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

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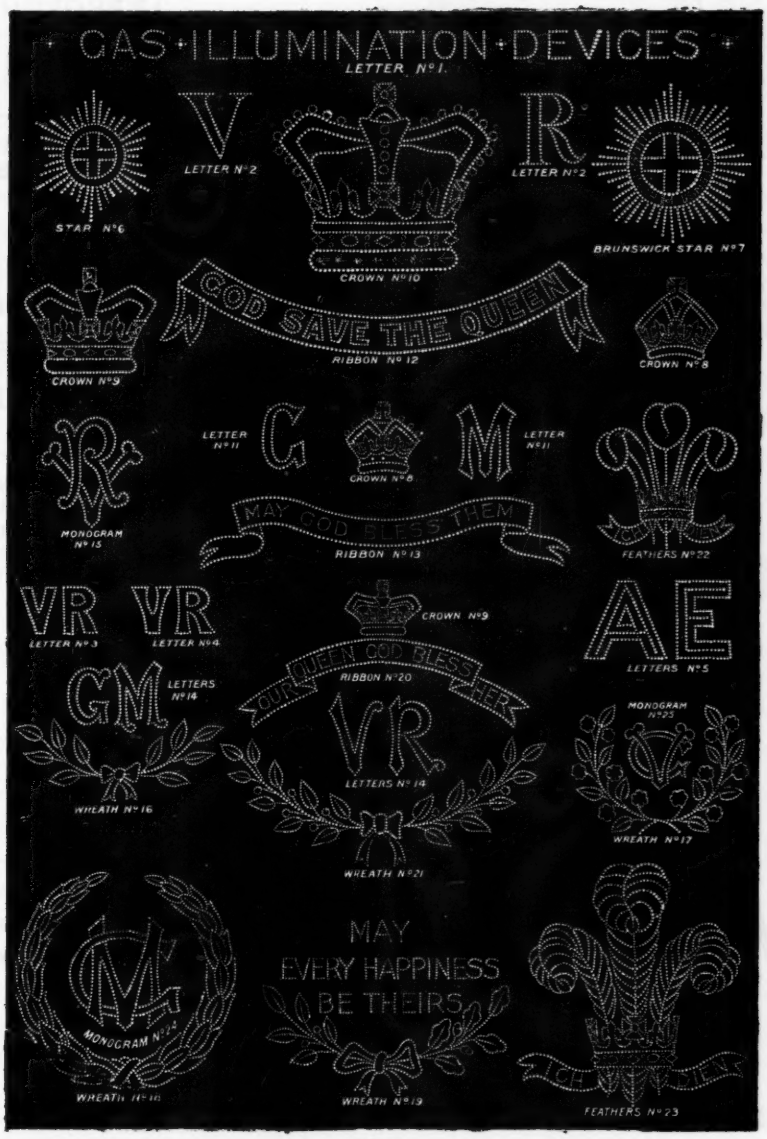
ON THE OCCASION OF THE

ROYAL WEDDING.

TRANSPARENCIES.



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Price List and Designs sent on Application.

We specially wish to impress upon our friends the importance of securing orders as early as possible.

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General Superintendent & Chief Engineer,
The United Gas Improvement Company, U.S.A.

A. G. GLASGOW, M.E.,
Late General Inspector,
The United Gas Improvement Company, U.S.A.

HUMPHREYS & GLASGOW,

Contracting Engineers for Water Gas Plant,
9, Victoria Street, London, S.W.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,
WORTLEY FIRE-CLAY WORKS
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES
AND
CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE
CLAY CROSS COMPANY,
CHESTERFIELD.

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MARK.	CLAY CROSS.	130, ST. SUFFOLK ST., S.E.

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IMPROVED
Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICE APPLY TO

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The Apparatus has been supplied to the following Firms—

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ANIMAL CHARCOAL CO., Limited, SHADWELL.
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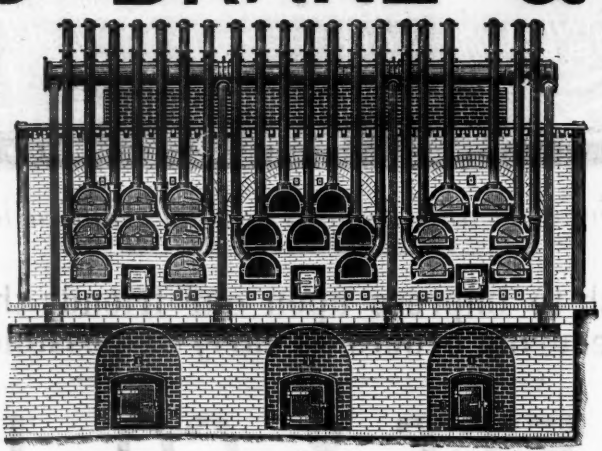
GAS ENGINEERS,
CONTRACTORS,
IRONFOUNDERS,

BUILDERS AND ERECTORS OF EVERY DESCRIPTION OF OVENS, BENCHES, KILNS, FURNACES, &c.



RETORT SETTERS,
FURNACE BUILDERS
ETC., ETC.

REGENERATOR AND GENERATOR FURNACES ON DRAKE'S, FRITH'S, SIEMENS'S, KLONNE'S, HASSE'S, VALON'S, SOMERVILLE'S, PONSARD'S and other Principles.

INCLINED RETORTS
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RETORT SETTING IN ALL ITS PRINCIPLES AND BRANCHES. BENCHES FITTED UP COMPLETE.
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GAS ILLUMINATION DEVICES.

Apply for the most original sheet of Designs in the Trade, to

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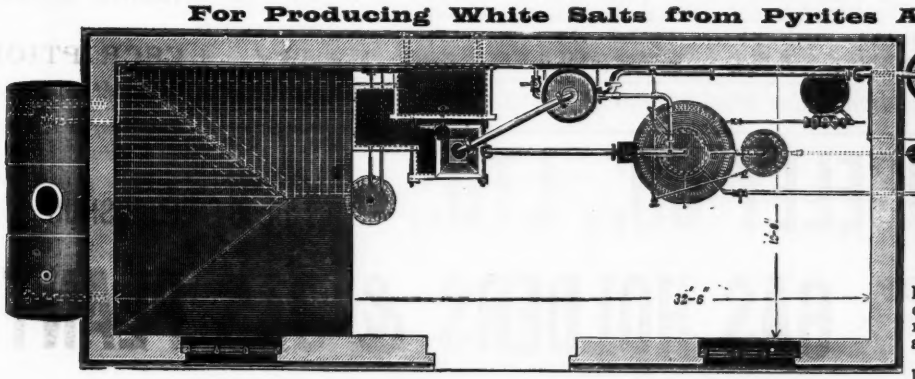
SULPHATE OF AMMONIA PLANTS

For Producing White Salts from Pyrites Acid.



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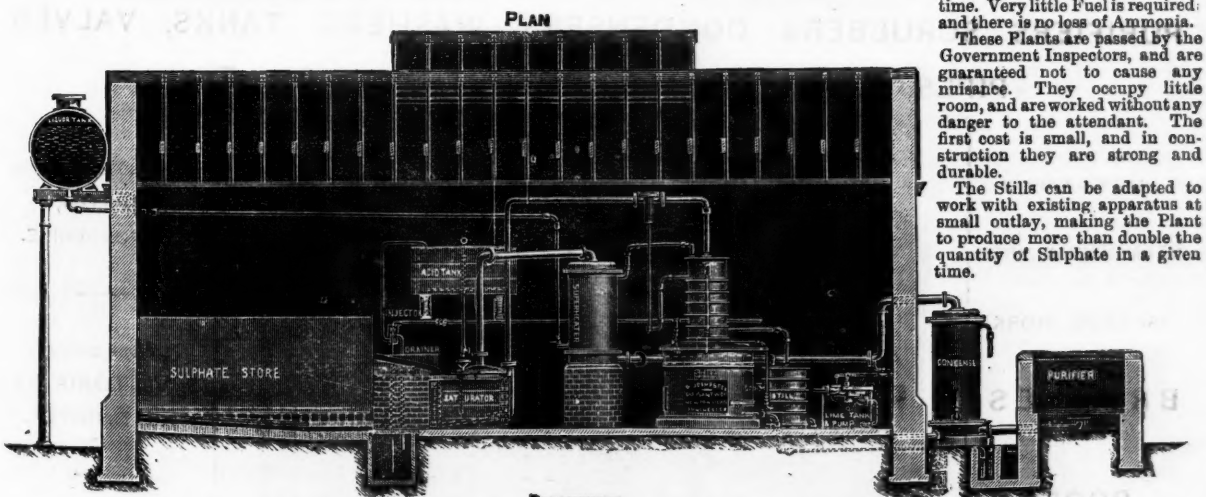
PLAN



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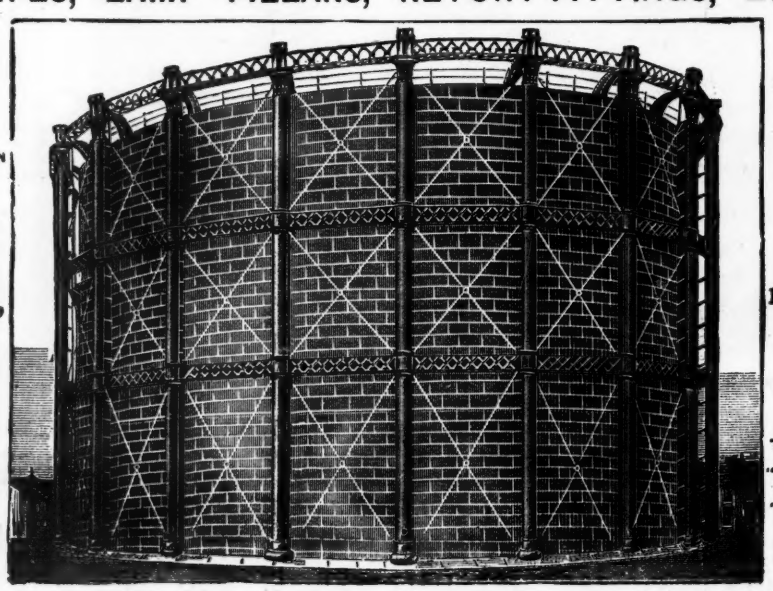

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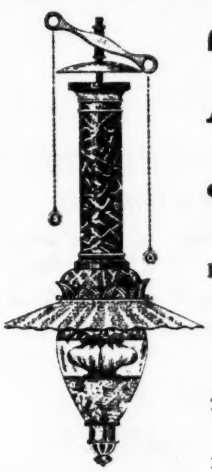

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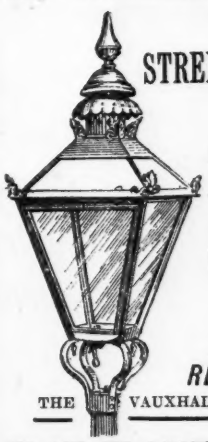

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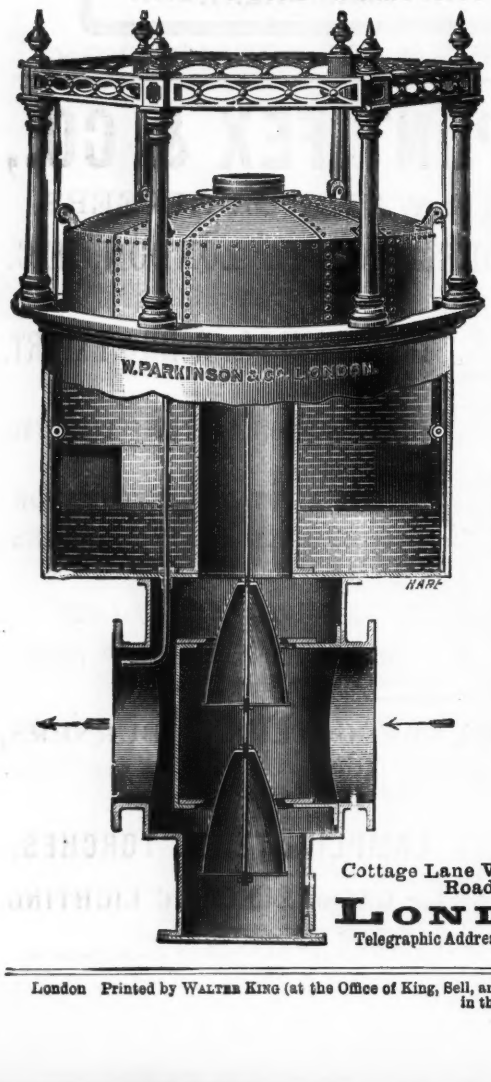

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[See also Advt., p. 1082.

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